



Chemical Engineering

MAY 1955

NEW TECHNIQUES IN



SERVE CHEMICAL, METALLURGICAL
AND PETROCHEMICAL OPERATIONS

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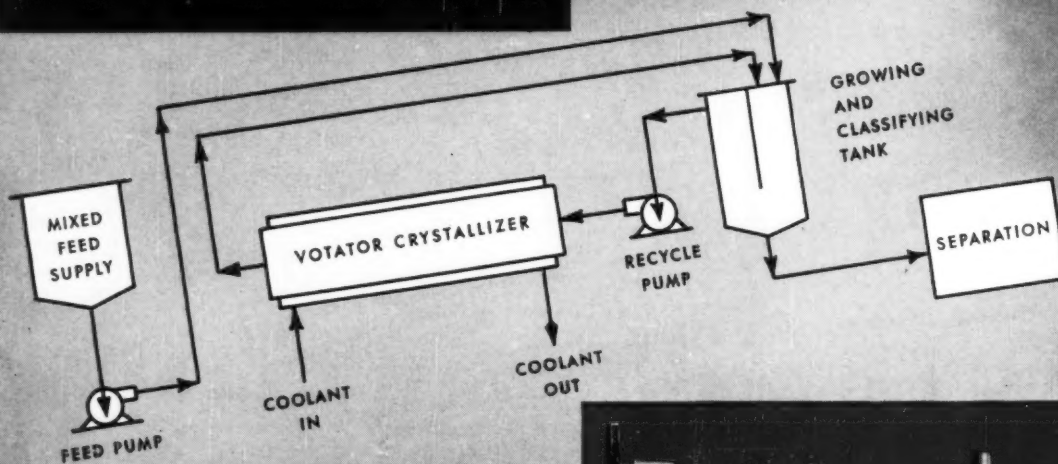
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A MCGRAW-HILL PUBLICATION

ONE DOLLAR

CONTINUOUS CRYSTALLIZATION



FLOW DIAGRAM
CONTINUOUS CRYSTALLIZATION
IN VOTATOR PROCESSING APPARATUS



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THE VOTATOR* Continuous Crystallizer provides the following advantages, compared to conventional batch crystallizing:

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GUIDED TOUR

JOHN R. CALLAHAM, EDITOR

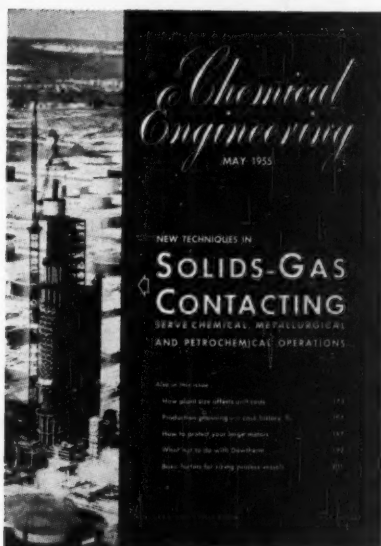


Photo by Sun Oil Co.

Liquid-Solids Separation

Next month we'll feature a special report on Liquid-Solids Separation, an important field to engineers throughout the process industries.

You'll find this report—a 64-page critical analysis—full of practical value for engineers dealing with the separation of liquids from solids. We've worked on it for over a year.

First section will be a critical evaluation of how to approach your separation problem. Following sections will then deal with screening, filtration (gravity, vacuum, pressure), centrifugation, cyclones, thickening.

Each section will tackle its field from two angles: operating principles and equipment evaluation. Emphasis will be on practical aspects for men in design, development, operations and maintenance.

Our reader surveys show this is a subject you've wanted covered. And the way we're treating it is what you've been asking for.

Don't miss Liquid-Solids Separation. That's next month!—JRC

... Will new techniques in solids-gas contacting affect your process?

They will if your operations are in the chemical, petrochemical or metallurgical fields. For techniques already proved in petroleum also have vast potential in other processing operations. Here's an orientation survey of the eight principal ways to contact solids with gases, where they're used and how (p. 163). Moving-bed processes, just entering the chemical field, will be featured in July.

How to size your process vessels.

Here're the basic factors for quick sizing of three types of pressure vessels used in petroleum and chemical plants. They do away with over-design—make your sizing job easier, too. (p. 201)

What NOT to do with Dowtherm.

W. L. Badger, digging deep into his vast experiences, recalls famous failures and why they failed. His advice can help

Please turn page

GUIDED TOUR



you do a better job in designing your equipment and heating systems. (p. 192)



How to protect your large motors.

It pays to take special care of big motors in processing areas. Here's top-notch advice on how you can guard them against damage from moisture, heat, corrosion, explosion, abrasion. (p. 187)



More tricks, kinks and shortcuts.

Plant Notebook brings more how-to tricks to save you time and money: spot bottlenecks in your batch process, get linear spacing on logarithmic scales, meter heavy slurries in pilot plants. (p. 208)



Develop your executive skills today.

Some day you may need them in a hurry; it's later than you think. Learn now how to take the total view, time your decisions, guide your engineering outlook into an executive asset. (p. 220)



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Chemical Engineering

MAY
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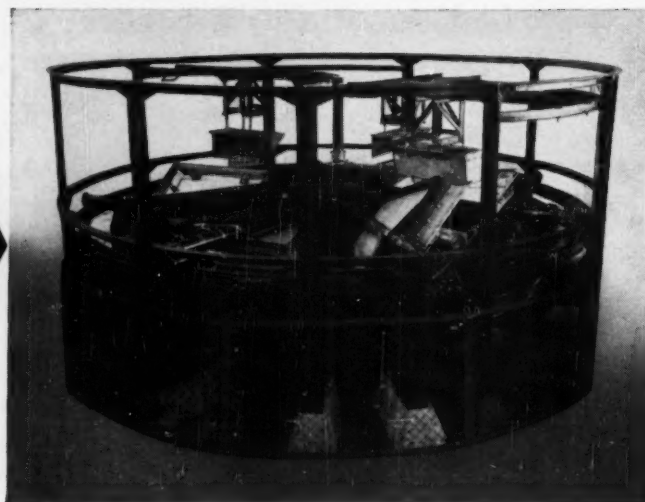
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To keep pace with the chemical, petrochemical and chemical process industries, more engineers subscribe to Chemical Engineering than to any other publication. Total net paid circulation of this issue:

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- ... whenever cake wash is of prime importance
- ... whenever you want to filter tonnages, big or small, using only one Filter (no stand-by equipment required)



- ... whenever you're dealing with materials that tend to blind filter cloths

the
BIRD-PRAYON

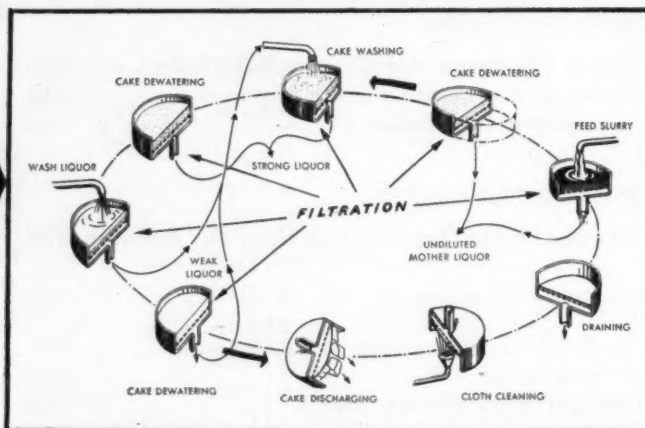
Continuous
Rotary
Horizontal

**VACUUM
FILTER**

THIS SHOWS YOU WHY

The Bird-Prayon Filter operates on this continuous automatic cycle.

As many as five stages of counter-current wash are permitted. Wash liquors are kept completely separate from the mother liquor and from each other. Evaporation costs are slashed.

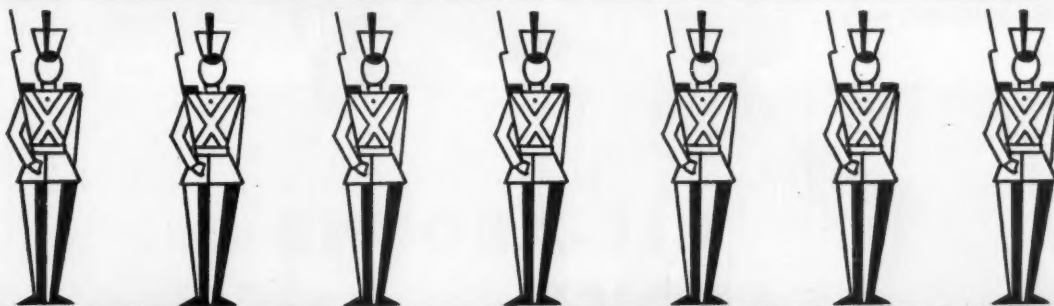


Complete cake discharge is effected by the 180° tray inversion. The cloth is clean as new each time it takes the feed.

Get The Facts

on this efficient, useful Filter. Ask us to send you the new Bird-Prayon Filter Bulletin — just off the press.

BIRD MACHINE COMPANY
SOUTH WALPOLE • MASSACHUSETTS



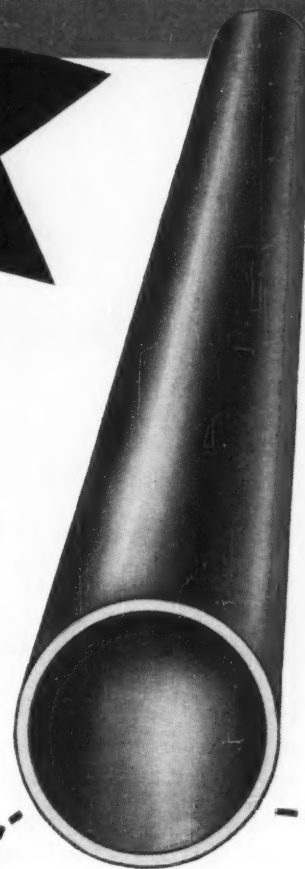
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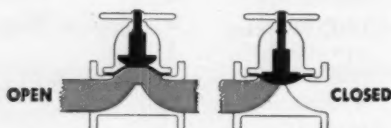
ALL-AROUND CHOICE

in industrial circles!

GRINNELL-SAUNDERS DIAPHRAGM VALVES

In industrial plants all around, Grinnell-Saunders Diaphragm Valves are preferred. *Why?* Because they have proved themselves economical and efficient in handling materials as diversified as corrosive fluids, gases, beverages, foods, compressed air, suspended solids . . . in lines where corrosion, abrasion, contamination, clogging, leakage and maintenance are costly factors.

Grinnell-Saunders Diaphragm Valves are available in a range of bodies, linings and diaphragm materials . . . and in a variety of styles and operating mechanisms. If you have a valve problem, it certainly will be well worth your while to consult a Grinnell engineer.



Types of Grinnell-Saunders Diaphragm Valves

Bodies

Screwed ends — 1/4" thru 3"
Flanged ends — lined or unlined, 1/2" thru 18"
Butt weld ends — 1/2" thru 6"
Socket ends — 1/2" thru 4"

Angle Bodies

Screwed ends — 1/4", 3/8", 1/2", 3/4", 1 1/4", 2"
Flanged ends — 3/4" thru 6"

Bonnets

Handwheel operated bonnet (available with rising stem, travel stops, extended stem, chainwheel, adapted for Tejax indicator)

Quick turn — lever operated bonnet, 1/2" thru 3"

Bendix-Westinghouse topworks

standard (air to close — spring to open)

Robotair, 1/4" thru 1"

Rotochamber, 1" thru 4"; in tandem, 5", 6"

direct acting (spring to close — air to open)

Robotair, 1/4" thru 1"

Rotochamber, 1" thru 4"

double acting (air to close — air to open)

Robotair, 1/4" thru 1"

Rotochamber, 1" thru 4"

Piston operated, 6" thru 12"

Sliding stem bonnet, 1/2" thru 12"

Diaphragms

Natural rubber, neoprene, reinforced neoprene for vacuum, hycar, butyl, white gum rubber, Kel-F, Teflon, polyethylene.

Body Materials

Iron, bronze, stainless steel, cast steel, aluminum, monel, saran, durimet

Body Linings

Glass, lead, soft rubber, hard rubber, neoprene, saran

Bronze Beer Valves

Socket both ends

Socket end to flange end

Flange both ends

Socket end to male hose thread end

Flange end to male hose thread end

Male hose thread both ends

GRINNELL

WHENEVER PIPING IS INVOLVED



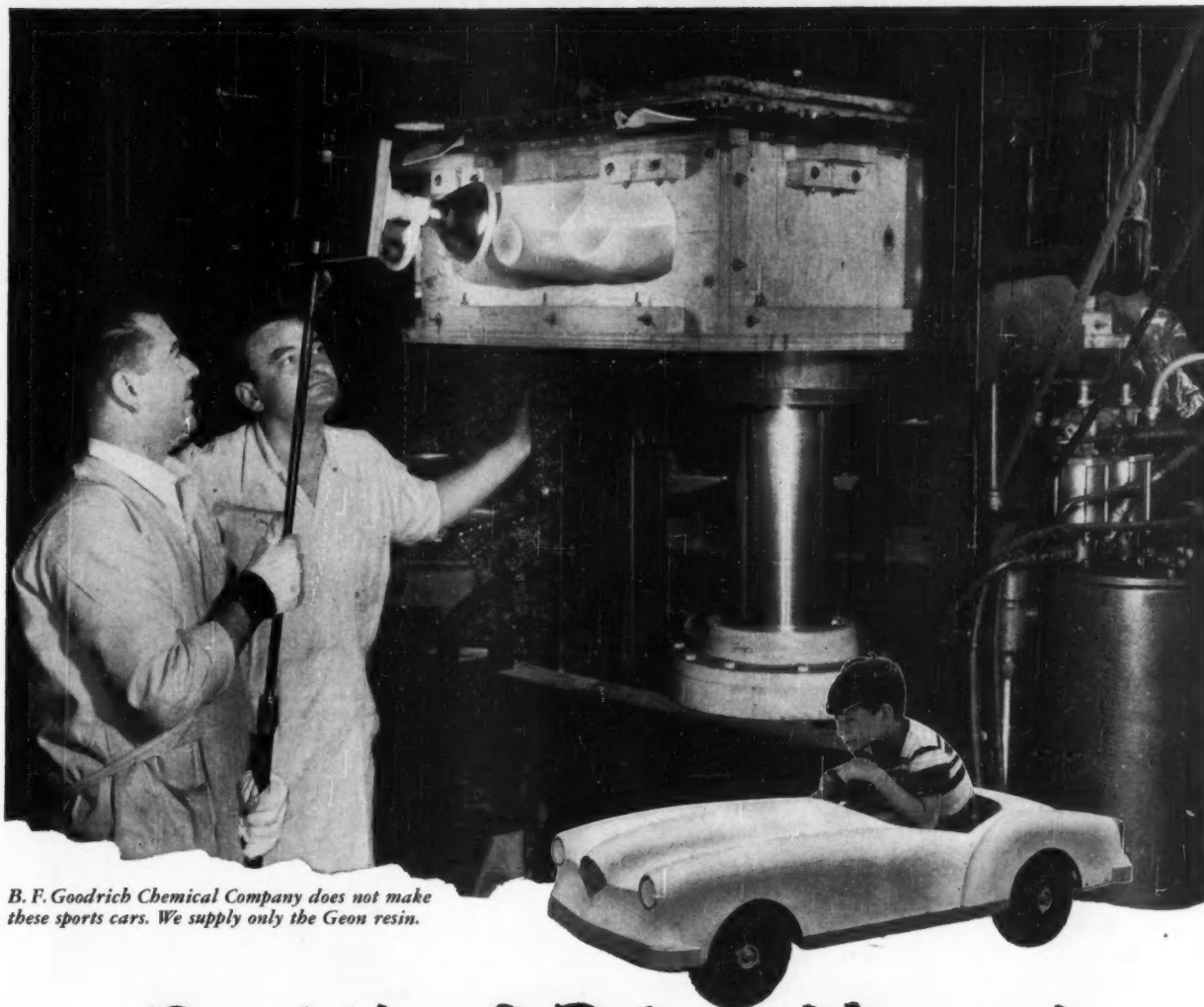
Grinnell Company, Inc., Providence, Rhode Island

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Another new development using

B. F. Goodrich Chemical *raw materials*



B. F. Goodrich Chemical Company does not make these sports cars. We supply only the Geon resin.

Rigid Vinyl Rides a Winner!

THESE 5-foot models of a famous sports car—prizes in a recent contest—had to be made on a hurry-up schedule and a hold-it-down budget. Using high impact rigid vinyl made from Geon resin, the fabricator was able to turn the cars out quickly, cheaply, and easily.

Oven-heated sheets pre-cut to size were placed in an inexpensive forming die and deep drawn. The whole cycle, heating included, took less than ten minutes. The fabrication included ingenious vacuum-formed

under-cut sections to match the design of the parent model.

This is typical of the fine detail work which can be formed from versatile Geon without incurring heavy tooling costs. It may suggest an improvement, a new idea, or a way to save money or time in your own operations.

Geon is available in many forms, including materials for colorful flexible upholstery, long-lasting floor coverings, tough insulation for wires, durable coatings, sponges, and many more. For information on Geon ma-

terials and applications, please write Dept. BB-5, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.



GEON RESINS • GOOD-RITE PLASTICIZERS . . . the ideal team to make products easier, better and more saleable.

GEON polyvinyl materials • HYCAR American rubber and latex • GOOD-RITE chemicals and plasticizers • HARMON colors

There's No Other Welding Tee Like This!



FLOWLINE

TRADE MARK

STAINLESS STEEL, MONEL, NICKEL and ALUMINUM WELDING FITTINGS
Preferred for Dependable Corrosion Service

The Welding Fittings organization — recognizing the superiority of welded piping for corrosion service — was the first to standardize, manufacture, and stock a complete line of stainless steel welding fittings.

The tee shown above—typical of all FLOWLINE Welding Fittings—provides unique features that have been developed through long, intensive specialization in design and production of welding fittings for corrosion service.

FLOWLINE fittings—tees, ells, reducers, stub ends, and caps—are available in sizes $\frac{1}{2}$ " through 12", in Schedules 5S, 10S, 40S, and 80S.

WELDING FITTINGS CORP.

NEW CASTLE, PENNSYLVANIA

W-10

World's Largest Manufacturer of Stainless Welding Fittings

Features of FLOWLINE Tees

- Cold formed — seamless — by the exclusive Welding Fittings process.
- Reinforced crotch—tee is stronger than pipe with which it is used.
- Full center to face dimensions.
- Smooth interior walls.
- Ends machine tool cut and finished.
- Annealed, cleaned bright, passivated.
- Heat number permanently stamped on each tee as record of actual analysis and physical properties.
- Every tee is marked with type of metal, size, schedule, wall thickness, and FLOWLINE trade mark.



These **BIRDS** Do **FINE** Work As Well As **COARSE** . . .

Most everybody is familiar with the ability of the Bird Centrifugal Filter to dewater big tonnages of coarse solids such as coal and potash ores from 0 to $\frac{1}{4}$ " size.

But don't lose sight of the fact that BIRDS are equally effective when it comes to filtering or classifying solids in the low micron range.

FILTERING. One BIRD is dewatering five different chrome pigments. A simple adjustment of operating speed for each pigment keeps the effluents practically water clear. The solids discharge is perfect for the drum dryer. The whole operation flows continuously right through final packaging. The pigments stay clean and pure as well as uniform. The BIRD runs for a minimum of two years without overhaul.

CLASSIFYING. Another BIRD is classifying a carbonaceous slurry of iron oxide to deliver a product of 100% minus 5 microns. The feed contains 64% plus 5 micron material. The Classifier is in closed circuit with the grinders and plus 5 micron solids are continuously recycled. As a result grinding efficiency is high.

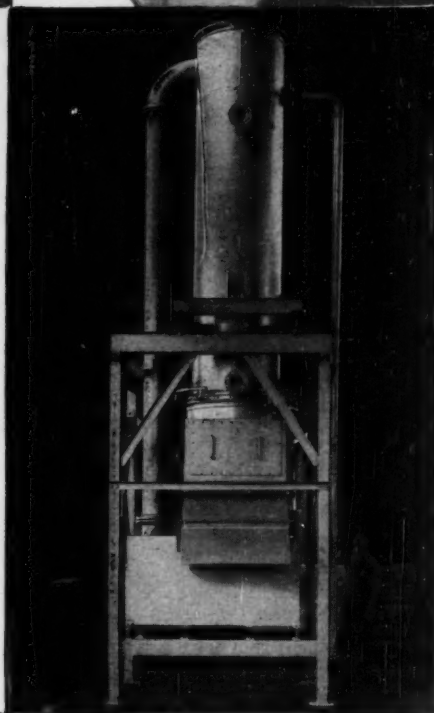
BIRD MACHINE COMPANY
SOUTH WALPOLE • MASSACHUSETTS

*
this machine
congeals,
molds and
discharges
automatically

"What is your processing problem?"



*If your process
involves a liquid
that will solidify
when cooled....
...this machine
can do it...then
discharge and size
the substance....
all automatically



If you have a processing problem, perhaps the Vogt Automatic Tube-Type Molding Machine will provide the answer because it will form and size any liquid that will solidify when cooled, and will discharge by gravity upon heating.

Now in use by major chemical companies, these units have achieved tremendous savings in labor while producing a more uniform product. Also, since the process involves "freezing" or solidifying the substance while it circulates through tubes, the quality of the product is often superior to that of the original charge.

The wide range of uses to which Vogt Tube-Type Molding Machines have been adapted indicates their definite value in the chemical processing field. Adaptation possibilities are virtually unlimited and you may request detailed technical information from our engineers without obligation.

Vogt

Automatic Tube-Type

MOLDING MACHINE

HENRY VOGT MACHINE CO., LOUISVILLE, KY.

BRANCH OFFICES: New York, Philadelphia, Chicago, Cleveland,
St. Louis, Dallas, Charleston, W. Va.



In fully-staffed, modern laboratory, miniature equipment is used to test small batches sent to Link-Belt.

Full-scale facilities are used for large runs. Over 1000 of these tests have been made, on more than 100 products.

We'll work out drying, cooling or roasting procedures for you

WHAT's the best drying, cooling or roasting method for processing your materials? Hundreds of plants throughout the world have found an exact, detailed answer through Link-Belt test runs. Here's how it works:

- You send a representative sample of your product — a pound or a ton — with a complete description . . . covering initial moisture, critical temperatures and your merchandising objectives.
- On equipment like that shown above, our specialists conduct test-runs — find how to blend, compound or convert it to desired chemical composition. Our analytical laboratory will determine needed catalyst or agents to be added, if tests so indicate.
- With probable efficiencies decided, we'll lay out flow charts of methods you can follow in your own plant.

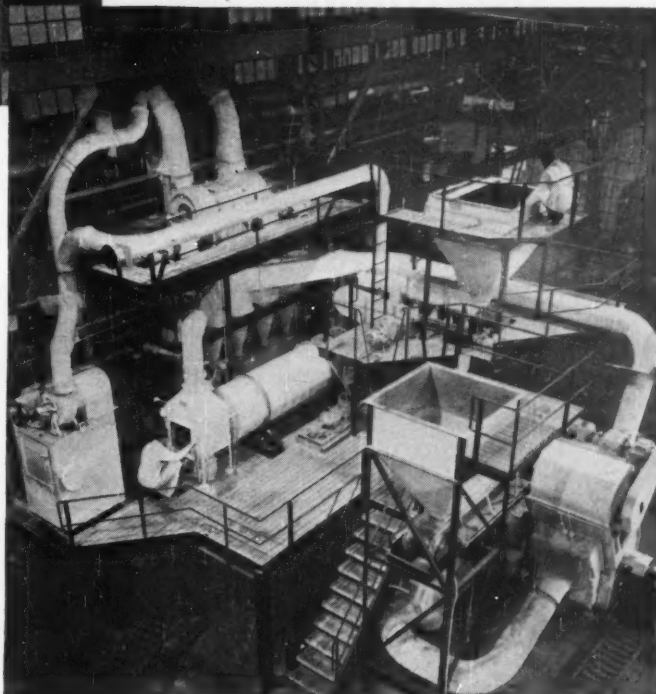
If shipping your product is impractical, we'll gladly set up a pilot unit on loan at your plant. Write or send samples to LINK-BELT COMPANY, 300 West Pershing Road, Chicago, Ill.

YOU'RE INVITED

**to send us a sample
of your material**

... a pound

or a ton...



LINK-BELT

DRYERS • COOLERS • ROASTERS



ROTO-LOUVRE



MULTI-LOUVRE



OSCILLOUVRE



MONOTUBE

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives 13792



Life

on the

Chemical

Newsfront



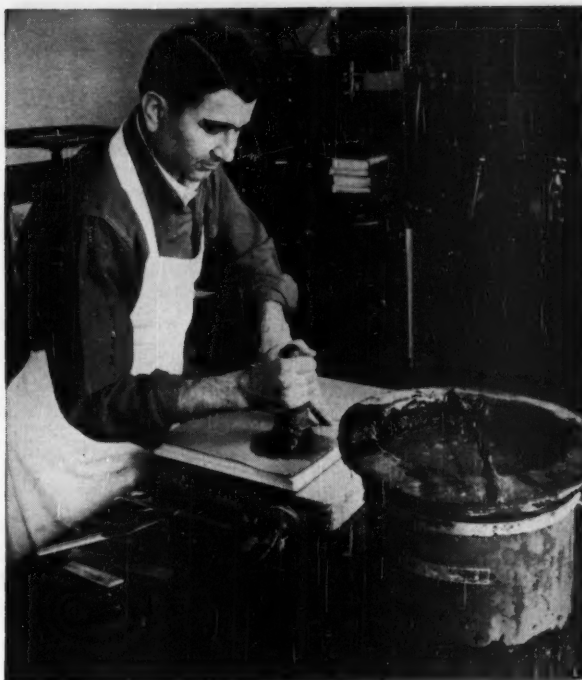
Photo courtesy American Fruit Grower

"ONE OF THE MOST USEFUL NEW INSECTICIDES." That's what State and Federal researchers say of Malathion, the versatile insecticidal chemical 0-0-dimethyl dithiophosphate of diethyl mercaptosuccinate, developed and manufactured by Cyanamid. For home garden use, Malathion is an all-purpose insecticide controlling a range of pests for which three or four insecticides were required previously. For agricultural use, the USDA accepts Malathion for control of more than 75 different insects on more than 40 crops, yet its toxicity to man and animals is very low, lower than DDT. Malathion residues disappear rapidly; usually less than one part per million remains ten days after application. It has a remarkable record of plant safety on practically all species of ornamentals, fruits and vegetables. (No. 1)



COAL MINERS STAKE THEIR LIVES on the blasting caps they use. At the Cleveland Coal Show, May 16-19, Cyanamid will exhibit to miners **AMERICAN Electric Blasting Caps** designed by Cyanamid research to assure maximum safety on every shot. The detonating power is more than sufficient to set off

most insensitive explosives. Color-coded Organosol insulation on the leg wires is compounded of 5 layers of plastic having high electrical and mechanical strength. Timing-precision, water-tightness and handling-ease give high reputation to these blasting caps among men who know blasting best. (No. 2)




ANIMAL GLUES STAY FLUID FOR DAYS with less than 1% of Cyanamid's Dicyandiamide (based on dry solids) added as the fluidizer. This *non-progressive* property imparted by dicyandiamide, a property many other fluidizers lack, means glues stay workable and spread smoothly for days, give better results, cost less. (No. 3)



GUANYLUREA PHOSPHATE is an effective corrosion inhibitor in the new water-based latex-type paints. No rusting of the tin can or discoloration of the paint were observed when about 1.0% guanylurea phosphate was used at pH 8. Hot aqueous solutions of guanylurea phosphate for metal cleaning remove rust and passivate steel surfaces by forming a phosphate coating. (No. 4)



TERMINAL BLOCKS WITH EXCEPTIONAL STRENGTH, both electrical and mechanical, are being molded for the U. S. Navy from Cyanamid's new MELMAC® Molding Material 3135, shown in the inset. A unique melamine-glass high-impact molding material, MELMAC 3135 has very high arc and flame resistance. It can be compression- or transfer-molded into small or large parts, can be preformed and preheated, and flows so well that intricate and thin-sectioned parts can be molded without "shorts." (No. 5)



AMERICAN Cyanamid COMPANY
30 ROCKEFELLER PLAZA
NEW YORK 20, NEW YORK

SEND more information on the following items mentioned in the May, 1955 issue of *LIFE* on the Chemical Newsfront: C.E.

No. 1, 2, 3, 4, 5.

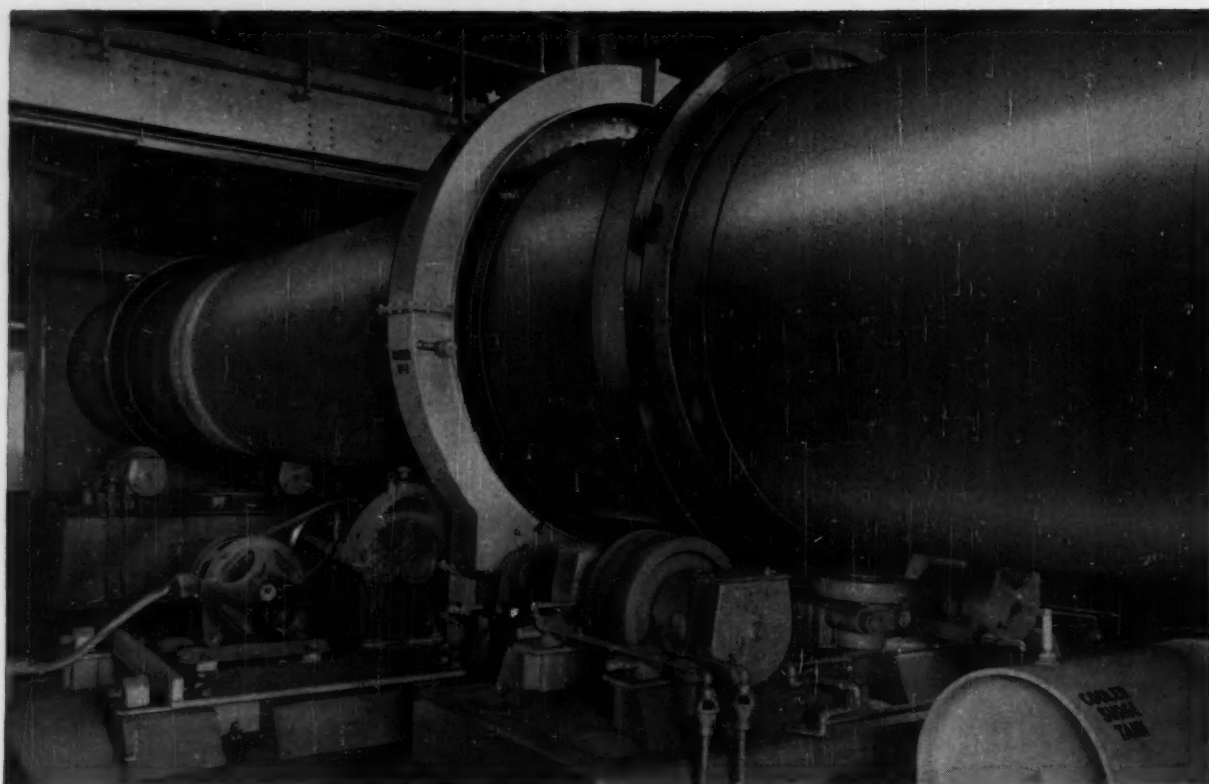
Literature ☐ Price ☐ Samples ☐ of _____

Name _____

Company _____

Address _____

City _____ Zone _____ State _____



IF YOUR MATERIAL COOLING PROBLEM IS a "hot" one to handle

LET TRAYLOR'S EXPERIENCE PROVIDE THE ANSWER

Controlled cooling of hot materials with Traylor Rotary Coolers has enabled many processors to greatly increase production efficiency and quality.

Every Traylor Cooler is "Traylor-Made" for its job only after careful study by Traylor engineers of the process involved. With over half a century of experience to provide the right answer, Traylor is well qualified to handle your "hottest" cooling problems.

Traylor builds several types of Rotary Coolers to meet practically all cooling requirements. Why not get in touch with us today. Let us show you why there is no substitute for a "Traylor-Made" Cooler.

TRAYLOR ENGINEERING & MFG. CO.

741 Mill St., Allentown, Pa.

Canadian Mfrs.: Canadian Vickers, Ltd., Montreal, P. Q.

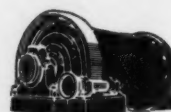


PRIMARY
GYRATORY CRUSHERS



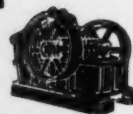
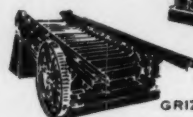
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How Olin Mathieson Uses Childers Jacketing For Insulated Lines

Jacketing problems at new plant ranged from covering tall towers to irregularly-shaped heat exchangers. Read how aluminum jacketing solved these problems.

Low first-cost, long life, and easy installation were the big reasons Olin Mathieson Chemical Corporation used Childers Aluminum Jacketing for outdoor insulated lines in their new Brandenburg, Ky., petrochemical plant.

Mathieson used Childers standard weight Jacketing on their insulated lines. Heavier weights of Childers Jacketing were used on high towers and vessels where a stiffer material was needed to support the vertical weight of the jacketing.

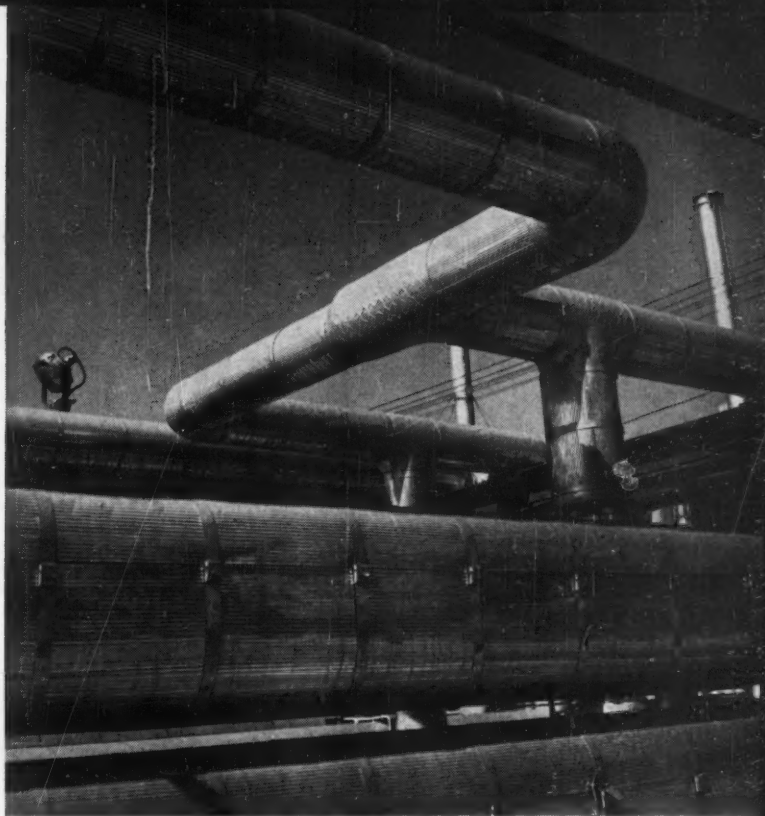
Engineers report that Childers Jacketing is inexpensive to apply. It comes in easy-to-handle rolls 4 ft. wide and 100 ft. long. Just pliers and a pocketknife are the only tools needed to apply. And because the jacketing is aluminum it needs no painting . . . stays clean

and new looking even after years of service.

Childers Jacketing is easily removable, too. Just remove the strapping and jacketing can be taken off for inspection of the lines. Then same jacketing can easily be put back on the insulated line.

Immediate shipment from our large factory stocks can eliminate costly delays in construction or plant improvement schedules.

Try this low-cost protection in your plant. Write today for engineering data and information. You can order a 400 sq. ft. roll to test on one of your insulated lines. No obligation. Address: Childers Manufacturing Company, Department CE 11, 3620 West 11th St., Houston, Texas.



More than 244,000 square feet of Childers .006" Jacketing and 35,000 square feet of heavy weight Childers Jacketing was used in this new Olin Mathieson plant to weather-proof insulated lines, towers and vessels. Close-up above shows how aluminum jacketing was applied with strapping and seals.

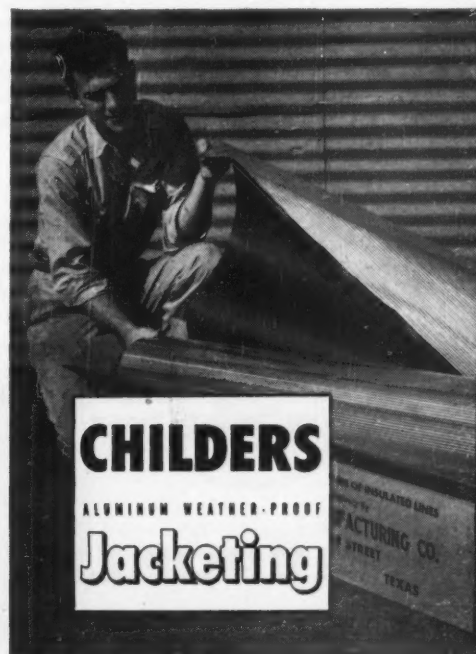
How to apply Childers Jacketing:



1. Best method of attaching jacketing is aluminum strapping and seals. Strapping can be pulled plenty tight with pliers like this. Other method is to use sheet metal screws.



2. A two-man crew can apply jacketing fastest. No special shop work or roll forming is necessary. Only tools needed are a pliers and a screw-driver or wooden wedge.



Each roll of Childers Jacketing comes individually packed like this in a heavy corrugated carton. Rolls are 4 ft. wide. With moisture barrier attached they are 100 ft. long; without moisture barrier they are 200 ft. long. They are well protected for field storage if kept dry. Individual boxes are light enough for one man to handle. (Adv.)

EVER LOOK TO A SUB'S PERISCOPE FOR YOUR IDEA?

Time was, when submarine periscope makers had a thriving replacement business. Probably no part of subs was as vulnerable to corrosion by ocean water as the periscopes. Even the toughest steels went to pieces so fast that spare periscopes were standard equipment.

But not any more!

Now Navy submarines are equipped with one single long-lasting titanium periscope. For titanium is the most corrosion-resistant commercial metal known. Even nitric acids and most chlorine compounds can't make a dent in it.

This should give you ideas about longer-lived chemical equipment . . . more enduring food-processing vats . . . permanent marine hardware . . . low-maintenance metal parts in severest service.

And don't dismiss titanium with the idea, "It's impossible to get" or "It costs a fortune." It is available today for civilian as well as military applications, and sales prices are lower than ever before.

Republic Steel and other producers are steadily increasing titanium smelting and rolling facilities. Presses are also being improved to help make more titanium available for more applications. You can start now to be informed and ready for the day when Republic Titanium and Titanium Alloys may be as easy to get as Republic Stainless and Alloy Steels.

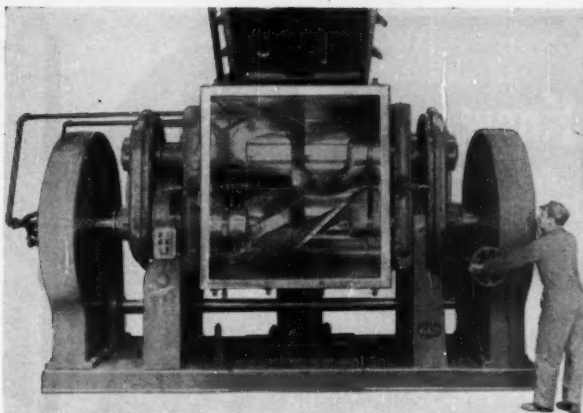
When you come to Republic for information on titanium, you're coming to the experienced leaders in corrosion-resistant metals. More than 47 years ago, Republic developed Toncan Iron to lick a corrosion problem . . . next came Republic Stainless Steel . . . and now Republic Titanium

Mail this coupon below to get information and data on the newest member of the Republic family of longer-lasting metals . . . Republic Titanium and Titanium Alloys.

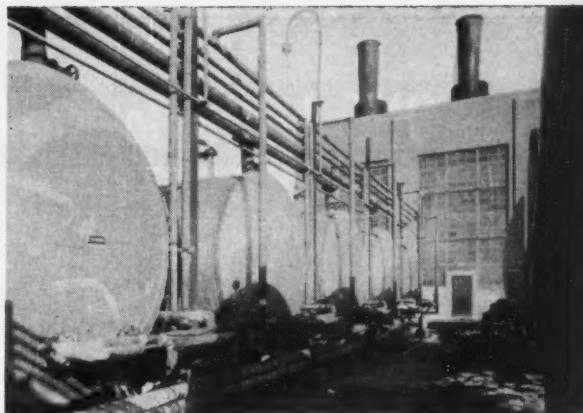
REPUBLIC STEEL

*World's Widest Range
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MIXING 800 GALLONS AT A TIME . . . and keeping them true and pure is the job of this giant steam-jacketed vacuum mixer for plastics. Republic ENDURO Stainless Steel protects the color, purity, and chemistry of the plastic from contamination and side reactions. If your equipment must protect product quality and color, build it from Republic ENDURO Stainless Steel sheets, plates, bars or shapes.



CORROSIVE CHEMICALS THAT HAVE TO BE BABIED are transported through ELECTRUNITE® Stainless Steel Tubing and Pipe, made by Republic's Steel and Tubes Division. Chemicals, food and dairy products receive positive protection against discoloration and contamination. And because ELECTRUNITE Stainless Steel Tubing and Pipe are corrosion-resistant and have a wide range of resistance to temperature, pressure and physical damage, they last years longer.

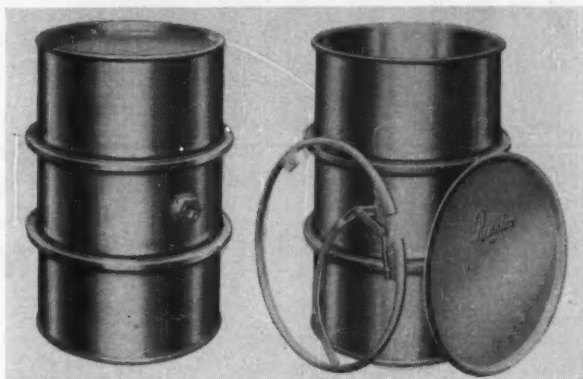
Republic Offers Several Answers To Corrosion Questions

For example, Republic High Strength Steels provide from 4 to 6 times as much resistance as ordinary steel to atmospheric corrosion. This means added life for railroad cars, trucks and similar equipment.

And, in metal drainage structures, Republic Toncan Iron, with a double helping of copper plus the correct addition of molybdenum, gives maximum corrosion-resistance to corrugated pipe buried in the earth.

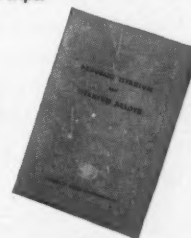
Republic Enduro Stainless Steel stands second high on our list of corrosion-resistant metals. Only Republic Titanium offers greater protection against corrosion. Republic Enduro Stainless Steel, in a variety of grades, is still the most economical metal available for most sanitary and corrosive applications.

For any corrosion problem, there's a Republic answer based on decades of experience and unbiased in favor of any one material. Republic makes many corrosion-resistant metals and alloys.



WHEN YOUR PRODUCT GOES TO MARKET in Republic-made drums or barrels of ENDURO Stainless Steel, you know it will arrive as safe and pure and color-free as when it left your plant. Most food products, chemicals, and other materials do not attack stainless steel, are not contaminated or discolored by it. Stainless steel drums are light to save freight, never require painting or coating, withstand severe repeat trips.

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Cleveland 27, Ohio



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with

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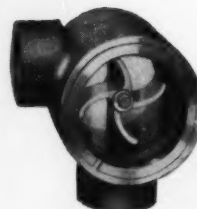
It's important to know at all times—what's going on . . . as well as what's going through !

You'll find OPW "VISI-FLO" Sight Glass Indicators a trustworthy visible means of alerting you as to rate of flow, viscosity, color of liquids, clarity and purity of product.

Whether it's entrained solids, gasoline, oil, water or even orange juice . . . "VISI-FLO" accurately shows you . . . helps you to insure protection against line stoppage . . . helps maintain uniformity, a high standard of product quality, and an even continuity of production.

From plain type to magnetic indicating type, the complete "VISI-FLO" line represents every application possible—vertical, horizontal, screwed end, flange type, with or without propeller. Manufactured in types for application to exposed pipes or for predesigned liquid channels incorporated in the machine.

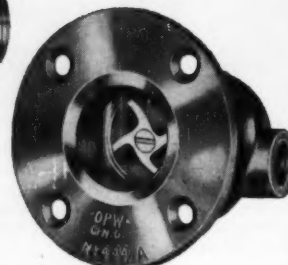
Write for **FREE BULLETIN F-6**, for full information, sizes, styles and engineering specifications.



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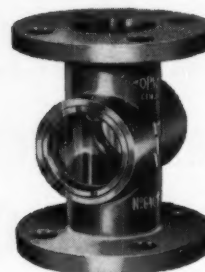
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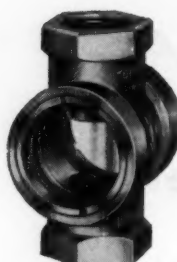
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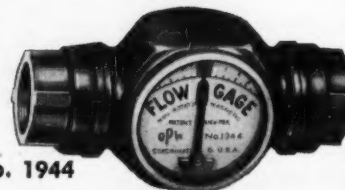
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May 1955—CHEMICAL ENGINEERING

Here's the lowest cost

TRAMP METAL PROTECTION

ever offered...

...It's the New
DINGS

"Universal Series" METAL DETECTOR

The new Dings Universal Series Metal Detector will detect the presence of all magnetic metals in materials that pass through the Detector Search Coil. Metals are thus detected in material in any form, whether in raw or finished conditions, in bulk or pressed form, liquid or viscous, granular or fibrous state. Even weakly magnetic metals such as manganese steel can be detected by this new, adjustable intensity unit.

Extremely simple in design, installation and operation, the new Dings Metal Detector requires virtually no attention. It is merely necessary to plug the unit into any single phase outlet, place the Search Coil around conveyor belt, and turn on the switch . . . and you have provided protection against tramp metal damage to machinery and product quality at an extremely low cost.

DINGS ELECTRONICS, INC.

(subsidiary of DINGS MAGNETIC SEPARATOR CO.)
4730 W. Electric Ave., Milwaukee 46, Wisconsin

- HERE ARE SOME OF ITS
OUTSTANDING FEATURES
- Wide range of sensitivity settings
 - Responds to manganese steel
 - Remote location of control cabinet (30-ft. of cable furnished)
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Dings

Magnetic Separation Leader for over 50 years

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DINGS ELECTRONICS, INC.
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Please rush further details about the new Dings Universal Series Metal Detector.

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THE BIGGEST

Announcing*

THE

LQ600 VALVE

ANOTHER LUNKENHEIMER "FIRST"
... the revolutionary new bronze valve which
has broken all existing performance records!



**LUNKENHEIMER THANKS ALL OF THE
LEADING COMPANIES WHO COOP-
ERATED IN THE FOUR-YEAR LQ600
FIELD TESTING PROGRAM**

The LQ600 Valve has been tested for four years in carefully chosen "problem installations" in American industry. *Despite the poor records of previous valves, there was not one single reported case of failure or leakage of an LQ600 Valve!* Here are a few typical records:

LUNKEN

THE ONE

Great

BRONZE VALVE NEWS IN 50 YEARS!



This revolutionary bronze globe valve has set completely new performance standards in the most severe service in industry!

LQ600 gives you so much *more* service per dollar that you can't afford to continue using bronze globe valves that require constant repair and replacement!

Valve users, cooperating in a four-year testing program, were unable to find *any* service tough enough to wear out an LQ600 — or cause it to leak, even in the most severe throttling installations! This new valve is an investment — one that pays cash dividends in maintenance savings year after year!

BRINALLOY* SEATS AND DISCS make these remarkable performance records possible. This exclusive new Lunkenheimer alloy is far more

resistant to wear and corrosion than 500 Brinell Stainless Steel — even outwears case hardened Stainless Steel exceeding 1000 Brinell! There is no need for renewability. *No LQ600 Valve in four years service has required maintenance.*

OTHER FEATURES — a streamlined new exterior . . . the famous Stemalloy® Stem, which far outlasts any other stem material . . . the cool, easy-to-grip Non-Slip® patented handwheel . . . durable, high-strength bronze in body and bonnet . . . and true back-seating, permitting safe and easy repacking under pressure.



*Patented alloy. Trade Mark, The Lunkenheimer Co.

For more information, call your local Lunkenheimer Distributor or write The Lunkenheimer Company, Box 360, Cincinnati 14, Ohio.

TYPE OF SERVICE	LIFE OF OTHER VALVES	USER COMMENT
125 lb. hose steaming	2 wks. to 2 mos.	Toughest service, previous valves leaked.
Water col. blowdown	2 mos.	Plug valves couldn't take it.
185 lb. steam blowdown	1 yr.	Plug valves failed every year.
125 lb. steam blowdown	"Short"	Previous valve leaked every run.
200 lb. steam—water col. blowdown	2 mos.	Previous valves failed by wiredrawing.
Throttling syrup 140°F.	"Short"	Previous valves cut.
150 lb. throttling 380°F.	6 mos.	Plug valves failed regularly.
100 lb. throttling	2 wks. to several mos.	Plug valves couldn't hold up.
130 lb. throttling	8 mos.	Composition seat valves unsatisfactory.
110 lb. throttling steam	3 wks. to 3 mos.	Three other kinds failed.
Scaled hot water line	"Short"	About all makes used—none held up.
125 lb. throttling steam	6 to 12 mos.	Plug valves failed by wiredrawing.
150 lb. steam—scale present	"Short"	Previous valves broke.
150 lb. throttling steam	4 to 5 mos.	Other makes failed by wiredrawing.

LQ600
150 LB. S.P.
300 LB. W.O.G.

HEIMER®

NAME IN VALVES

BRONZE • IRON
STEEL • PVC



It's in the Bag!

Fresh, Clean Ink for a Year of Trouble-free Recording

★ You won't have any messy, time-consuming re-inking of pens on the new Bailey Recorders. The entire system is white-glove clean—hermetically sealed, non-evaporating, non-corrosive. Gone is any chance of sludge or oxide formation. Gone are clogged pens, interrupted records, unsightly splashes.

The transparent plastic ink sacs are changed once a year—that's all. Capillary tubing carries fresh, clean ink to the pens continuously without any day-to-day attention.

This exclusive new inking system* is only one of the many time-saving, money-saving distinctive features of the new Bailey Recorder.

Ask for Product Specification E12-5.

P34-1

*Now available for the New Bailey Recorder only.



ONLY BAILEY OFFERS ALL THESE ADVANTAGES IN A SINGLE RECORDER

- Pre-calibrated plug-in receiver units
- Up to four pneumatic or electronic receivers—or two receivers and two integrators
- Any four variables on one chart—easily read and interpreted
- A full year's ink supply at one loading
- Faster ordering—from stock
- Minimum inventory of parts
- Minimum instrument investment for process cycle expansion or alteration

BAILEY

METER COMPANY

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CLEVELAND 10, OHIO

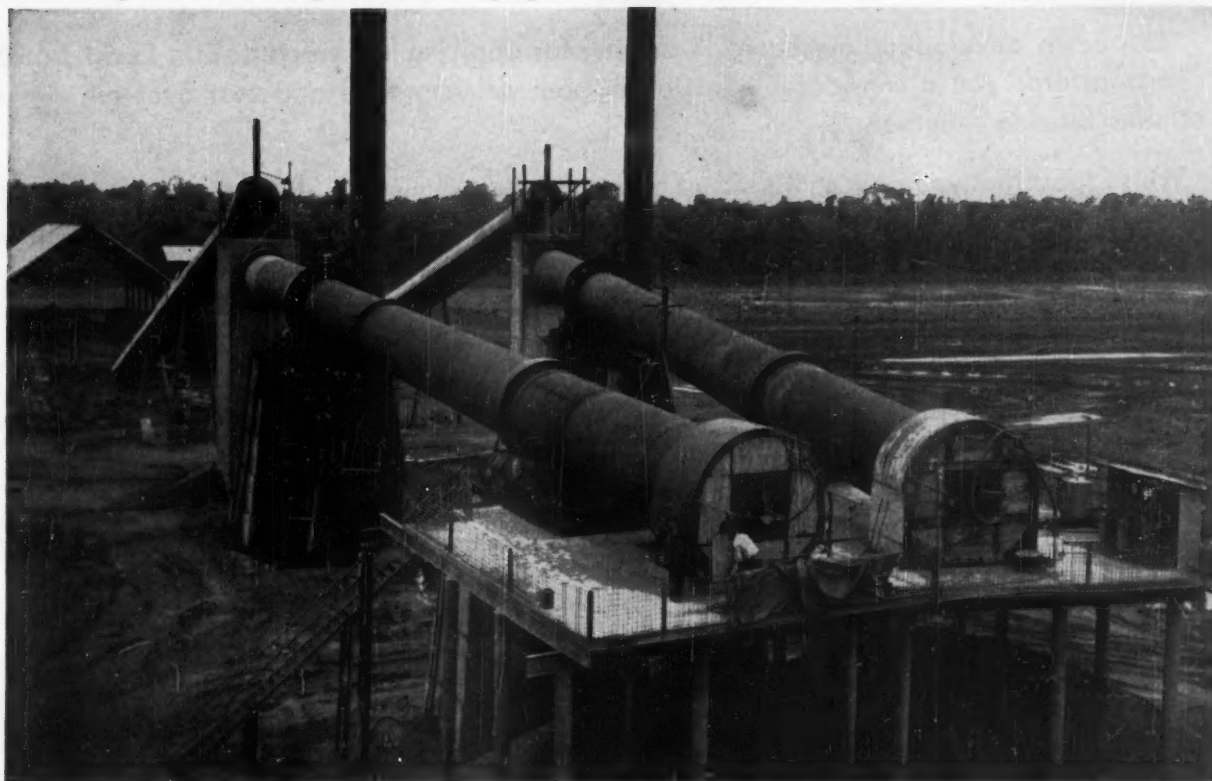
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Controls for
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FLOW · LEVEL
RATIO · DENSITY

BIGGEST

Lightweight Aggregate Kiln, anywhere



BUILT BY VULCAN

Shown above are two of the largest Kilns used anywhere for the production of lightweight aggregate.

You may wonder sometimes about a large piece of machinery: wonder if the tolerances and precision work usually found in small equipment are also in the big. You've got to have it—and VULCAN has always given it. VULCAN's previous installations have had to be good for them to be in business over 100 years.

These two Kilns shown are 8' x 165'. They are designed for modern, consistent 24-hour service; and because of the strenuous duty imposed on them, are somewhat heavier than what might be called a standard design.

Every bit of equipment made by the

VULCAN IRON WORKS must measure up to the standard of quality and responsibility it has taken years to earn. You can bet that if your equipment comes from VULCAN—you'll have nothing to worry about for years.

Any information on items listed below
will be sent to you immediately:

Rotary Kilns, Coolers and
Dryers
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Improved Vertical Lime Kilns
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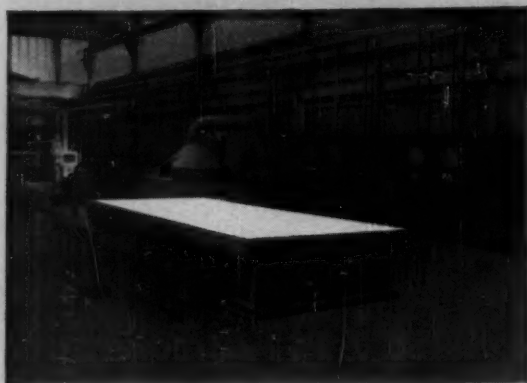
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Pioneers in **HOMOGENEOUS LEAD BONDING** *First Again with a "NEW MECHANICAL" Bonding Process*

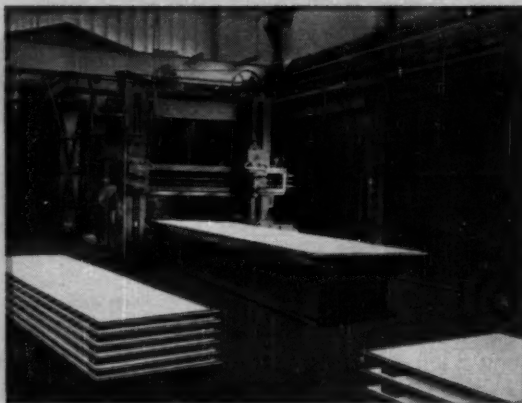
*Our newly developed "mechanical" process for applying **Homogeneous Lead Bondings** affords you a considerable saving in both delivery time and cost over the slower "hand-burning" method.

We suggest that you pay a visit to our plant and view this newly developed "Mechanical" cost-saving lead bonding process. Our Engineers are available for consultation without obligation. Your inquiries are solicited.



Homogeneous Lead Bondings are applied to any thickness of shell plates in the flat before shaping to your specifications. Plates as large as 10'-0" x 20'-0" are easily handled on our new unit, thus eliminating many unnecessary weld seams. Outlets and connections are Homogeneously Bonded regardless of size.

To insure uniform overall thickness of the Homogeneous Lead Bondings and eliminate the human errors occurring in other methods, lead is applied "oversize" to flat sheet plates and then planed to required thickness. In addition, this operation affords considerable savings in time over the general "Hand Scraping" method.



Dished Heads of all types and various irregular shaped pieces of equipment are Homogeneously Lead Bonded in our Special "MECHANICAL" Unit. Here again, considerable saving in time and cost is effected over the general method.

KELLEY Custom-Built for the Processing Industries

TANKS • LEAD COILS • LEAD & LEAD LINED VALVES
SHEET LEAD LININGS • CASTINGS & FITTINGS

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For the **toughest** service!

(for hot, concentrated sulfuric acid and other corrosives too severe for the stainless alloys)

The New
**DURCO Type M
Y Valve**

All parts in contact
with the solution are
**DURIRON or
DURICHLOR**



Corrosion resistant exterior trim: Yoke, yoke flange, gland, and gland follower are of Durimet 20. Bolts, nuts, and yoke bushing are of 18-8.

Valves are furnished with Teflon V-ring packing for positive stem sealing.

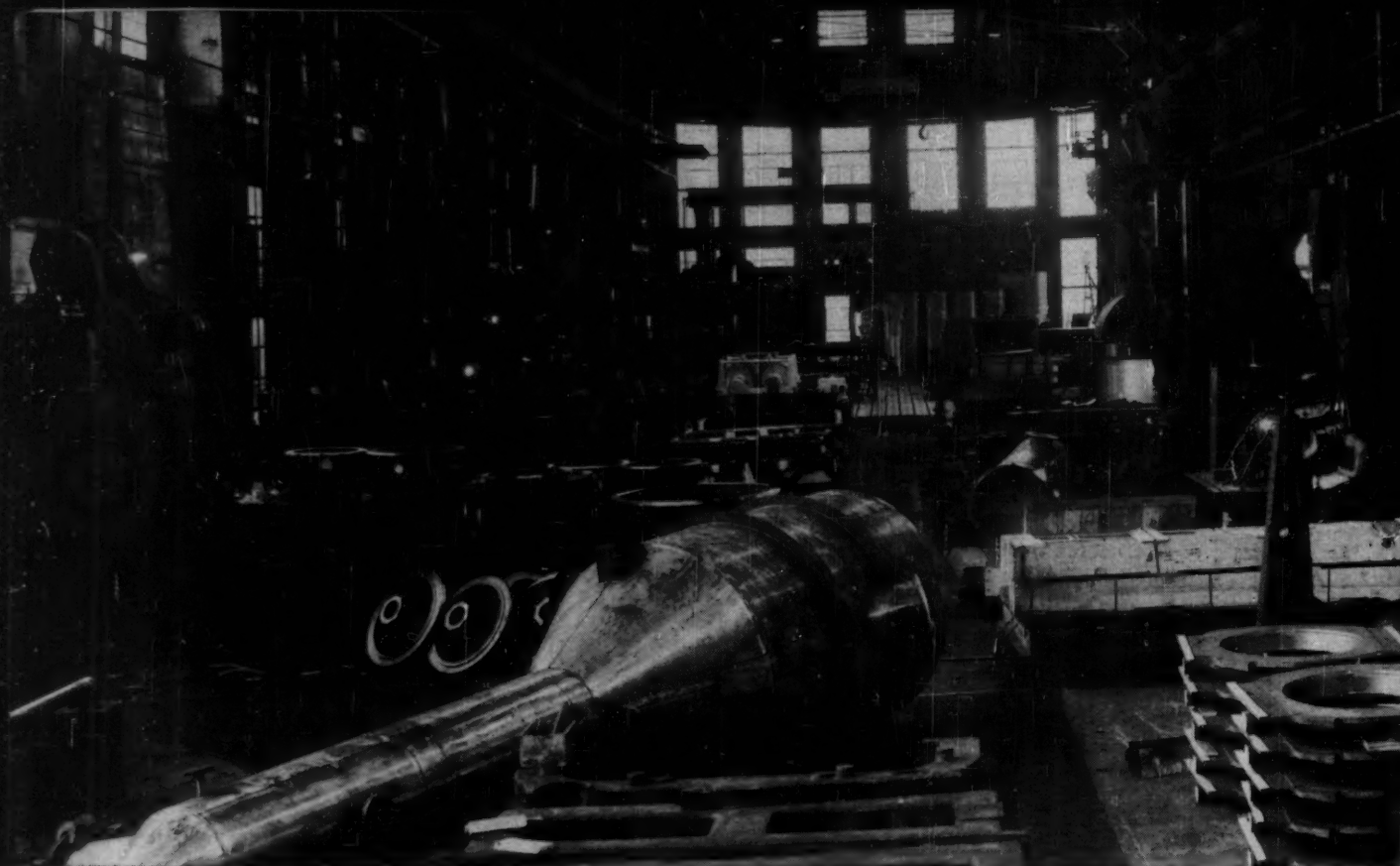
Sturdy construction throughout for maximum service life.

TYPE M VALVES IN DURIRON
ARE AVAILABLE FROM STOCK
IN SIZES 1" THROUGH 6"

THE DURIRON COMPANY, Inc.
Dayton 1, Ohio



Write for Bulletin V/8



Processing Equipment

any size . . . large or small . . .

- ★ Built to your design, the way you want it,
in **BUFLOVAK'S ENLARGED, MODERN PLANT**
- ★ Engineering, too, is available

Greatly enlarged facilities . . . new and improved machinery for fabricating heavier equipment at lower cost . . . a complete Machine Shop and a modern Fabrication Shop that handles plates up to 4 in. thick to all code specifications.

The successful solution of processing problems is a proven experience with BUFLOVAK. The benefits are shared profitably every day with many prominent firms in the food, chemical and petrochemical industries . . . your Company may be one of them.

Unraveling knotty processing problems and building the right equipment to do the job the way you want it done, begins with this simple BUFLOVAK premise: "the most important end product of your process is profit." Our engineering and production facilities are geared to that result. Whether the job is big or small, every step from drawing to finished product, is squared to that principle.

Here are four ways BUFLOVAK can help you with your process equipment requirements:

1. Building processing or special equipment to your specifications . . . any size . . . to any code requirements. Metal thickness up to 2½ in.; up to 4 in. thick later this year.
2. Equipment built to your basic design. We can supply all mechanical design and engineering to meet the most exacting requirements.
3. A process and equipment completely designed, beginning with practical research in the BUFLOVAK Laboratories to determine the best method and equipment to produce your product so it will meet your market requirements.
4. And, of course, there's a standard line of BUFLOVAK Processing Equipment that covers a wide range of evaporating, drying, solvent recovery, and by-product requirements.

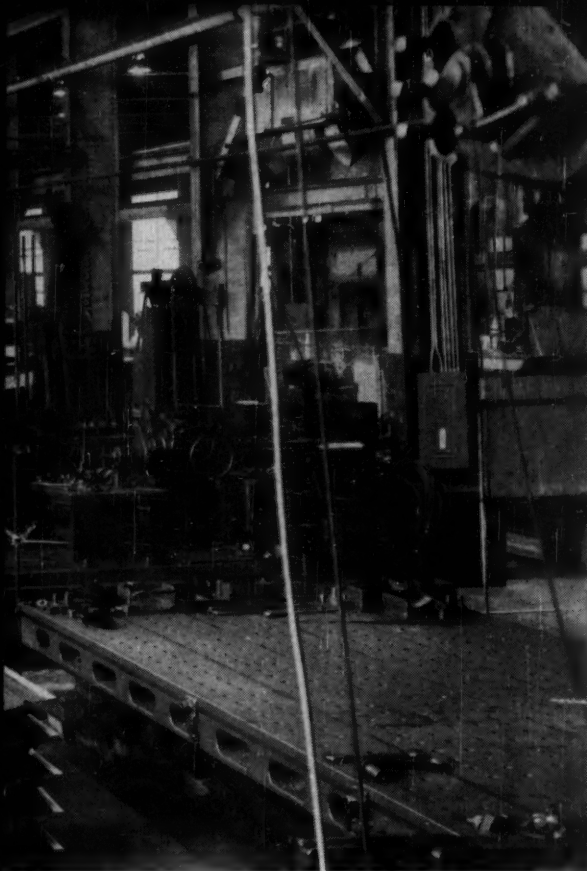


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BUFLOVAK EQUIPMENT DIVISION

1551 Fillmore Avenue, Buffalo 11, N. Y.





BUFLOVAK'S complete Machine Shop, with its modern, new equipment, is available for any job, large or small, from a pilot plant unit to the largest size complete processing system.

Shop facilities include:

Sheet and plate fabrication to all code requirements . . . Manual and automatic welding . . . Stress relieving . . . X-ray . . . Machine tools for accurate work on big jobs . . . Thorough shop inspection.

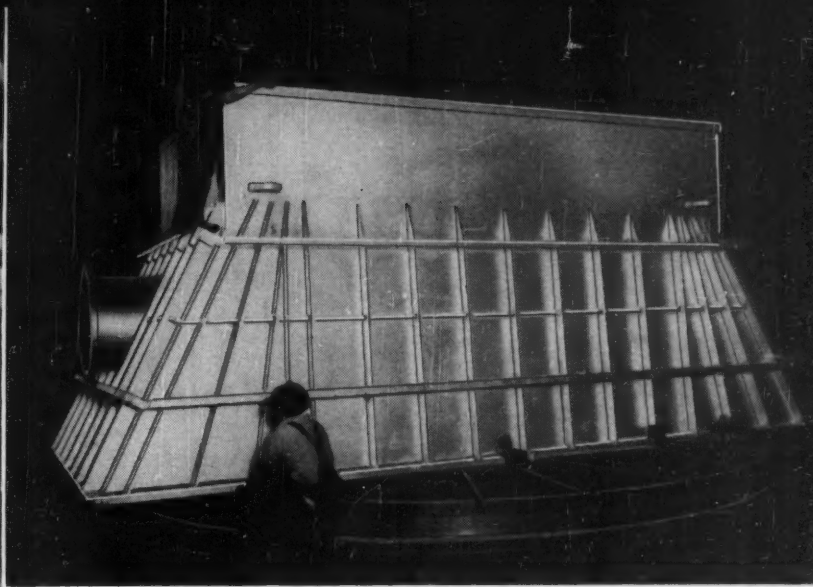
for fabricating to your drawings:

Autoclaves and kettles • Evaporators • Dryers • Digesters • Reactors • Mixers • and other equipment for any capacity, pressure, temperature, reaction.

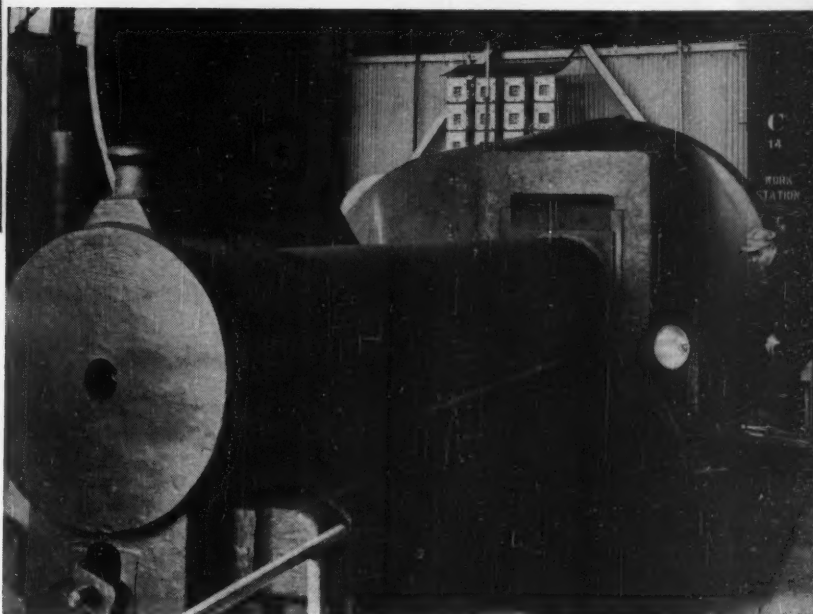
A Research and Testing Laboratory, equipped with pilot plant units, is available to help you find better processing methods for chemical and food products.

There are many ways to save money

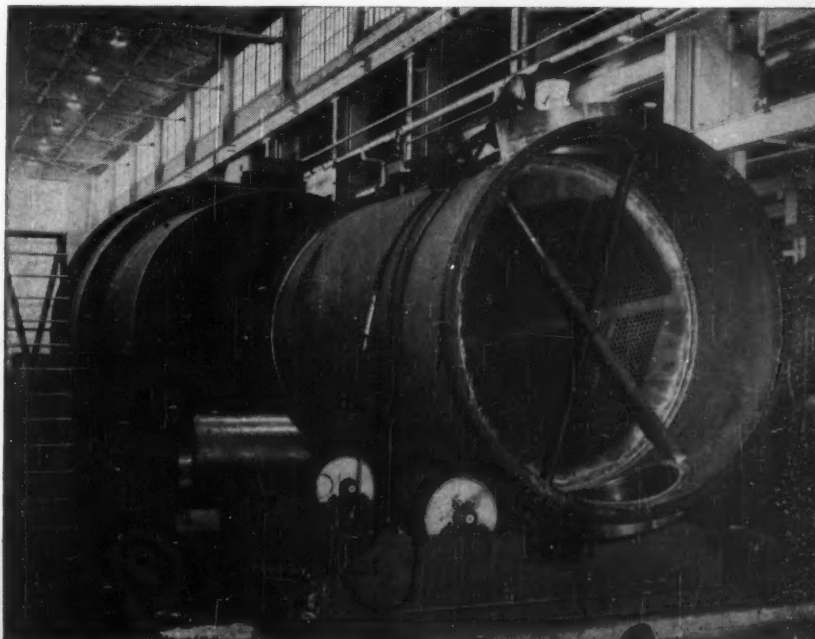
If you send us a description of your processing problem, or a blueprint of your design, we will send you our suggestions and an estimate . . . promptly.



This 25 ft. boring mill machines work up to 16 ft. under the tool and weighing up to 100 tons.

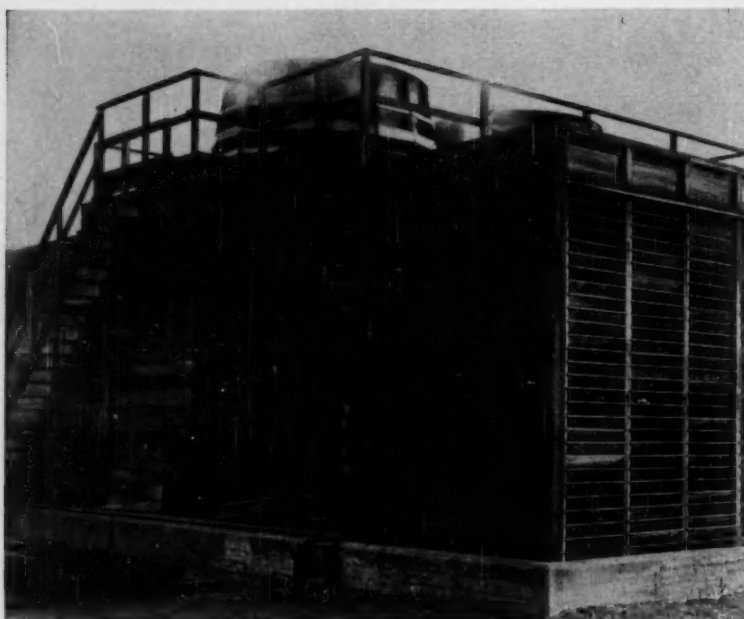


These new rolls form plates up to 12 ft. wide and 2½ in. thick. (Below) Fabricating a large nickel-clad evaporator steamchest.



for your information...

brief summaries of
helpful product news



PRODUCTION MEN CAN REDUCE MAINTENANCE HEADACHES WITH PENTA-TREATED LUMBER

Countless production men are discovering that wood works harder when it is preserved with Penta. This cooling tower, for instance, constructed with Penta-treated lumber, will give far longer maintenance-free service because:

Penta prevents wood decay, assures long life for both structural and baffle

spray bombardment. Costly cooling system shutdowns and repairs are eliminated.

And Penta-treated wood is clean, easy to handle; won't bleed to stain clothing, will not "burn" hands.

For full information on Monsanto Penta, just check the coupon and send it along to Monsanto,

New booklet tells how *molten phthalic and maleic anhydrides* save time, money

A new booklet, just off the press, details the important economies which can be achieved in handling phthalic and maleic anhydrides as molten liquids.

Savings in material costs, man-hours, and manufacturing procedures are effected because:

1. Raw material costs are lower ... savings on finishing and packaging are passed on to you— $\frac{1}{2}\text{¢}$ per pound on phthalic, 1¢ on maleic.
2. Processing up-heat time is cut. By pumping to kettle instead of dumping solids, phthalic anhydride reaches process at temperatures above 131°C. ; maleic anhydride above 52°C. Some plants report up to 10% output increase.
3. Pumping is cheaper, easier, faster than dumping. Less danger of contamination because material is confined in closed pipes; annoying fumes and dust are practically eliminated.
4. Inside warehouse space is not required. Handling phthalic and maleic anhydrides in piping-storage tank system saves under-roof warehouse space which can be used for finished product.

This new booklet also gives you recommended layout, materials of construction, unloading and pumping procedures.

Check the coupon for your copy.

Quick facts on Phenol

Handle phenol with greater safety by

- Equipping storage facilities with flame arrestor vents.
- Grounding all tank-car and storage facilities to avoid fire hazard.

For other useful information on how to handle, store, transfer, and unload phenol, send for your copy of "The Handling of Phenol."

More reports prove Aroclor 1248 is an effective heat- transfer medium

Reports received from installations show that Monsanto Aroclor* 1248, a chlorinated biphenyl, is proving to be a superior heat-transfer medium. A nonflammable, liquid-phase, heat-transfer fluid, it is designed for operation at atmospheric pressure at maximum temperature of 300° C.



The outstanding performance characteristics of Aroclor 1248 were demonstrated with a portable electric heater designed to reach temperatures not attained by ordinary steam pressures. Test results show Aroclor 1248 provides these advantages:

Freedom from fire hazard.

Viscosities which permit pumping at room temperatures.

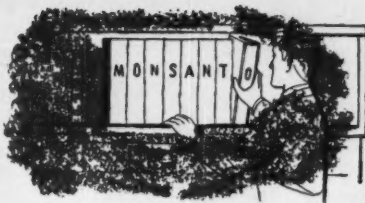
Boiling point sufficiently above 300° C. to assure liquid condition at all times.

Stability against heat, plus an adequate safety margin to accommodate accidental overheating.

Other advantages: controlled vaporization loss, less corrosive action, freedom from toxicity hazard (in properly enclosed systems).

Other uses for Aroclor 1248: as plasticizers in specialty lacquers, adhesives, vinyls, as ingredients in E. P. lubricants, high styrene butadiene stucco finishes, chlorinated rubber coatings.

For more information about Aroclor 1248, check the coupon at right.



New! Petroleum Rust Inhibitor Booklet

How Santolene* C helps the petroleum handling industry maintain product quality, cut overhaul and maintenance costs are just a few of the important subjects covered in this new 20-page technical bulletin.

Low concentrations of Santolene C, when added to light petroleum products, control rust and corrosion by establishing a film or barrier between metal surfaces and corrosive elements, preventing rust formation in tankers, pipe lines, storage tanks—in fact, almost all petroleum handling facilities.

For your copy of this informative booklet, write Monsanto today.

Ethavan and Vanillin add flavor boost to chocolate coatings

Taste and odor testing is fast becoming an additional method of processing control in a variety of industries. Formulators of hard butter and cocoa butter coatings, in



particular, are discovering how Monsanto Ethavan* (ethyl vanillin) and Vanillin can pep up the flavor of inexpensive hard butter coatings and smooth out the rich, full body of cocoa butter coatings.

Monsanto Vanillin and Ethavan, supplied in pure, fine crystal form, can be added to these coatings without diluting or lowering coating viscosity. Temperature extremes required for hot or cold processing do not affect Ethavan or Vanillin's flavor potency.

Test the quality of these two fine products yourself. A test kit containing three chocolate coating samples—a hard butter coating with Ethavan, a hard butter coating with Vanillin, and a cocoa butter coating with Vanillin—is tasty proof that Ethavan and Vanillin can give chocolates an important flavor boost so necessary for repeat sales.

For your test kit, check the handy coupon below.

*Reg. U. S. Pat. Off.



Serving Industry... Which Serves Mankind

MONSANTO CHEMICAL COMPANY
808 North 12th Street, St. Louis 1, Mo.

5/55

Please send:

- ☐ "Specify PENTA"
☐ "Reducing Costs by Handling Phthalic and Maleic Anhydrides as Molten Liquids"
☐ "The Handling of Phenol"

- ☐ Ethavan-Vanillin taste test kit
☐ "Santolene C Rust Inhibitor"
☐ "Aroclors," Technical Bulletin No. OP-115

Name.....Title.....

Company.....

Street.....

City.....Zone.....State.....

Spheres
Diameters from
3/16" to 1"

Rings
Sizes from 3/32" I.D. x
3/16" long x 7/32" O.D. to
1/2" I.D. x 1" long x 1" O.D.

Pellets
Sizes from 1/8" x 1/8"
to 1/2" x 1/2"

Norton catalyst carriers. ALUNDUM* (fused alpha alumina) carriers contain 77% to 89% alumina and are outstanding for chemical stability and resistance to abrasion and erosion. They are proving highly successful in fixed bed oxidation reactions — such as those involved in producing phthalic anhydride, maleic anhydride and ethylene oxide. Also, their inertness and low density are valuable properties for space filling and tower packing applications.

ALUNDUM carriers are commercially available in the form of spheres, rings and pellets. Also available in experimental quantities are carriers made of MAGNORITE*, CRYSTOLON*, Fused Stabilized Zirconia and Kyanite materials.

ALUNDUM spherical carriers provide uniform beds in catalytic converters, reducing channeling and pressure drop to a minimum. Medium porosity spheres (40% - 44%) have a network of open pores on the outside surface only. These are specifically recommended for applications where the carrier is coated with a catalyst. High porosity spheres (45% - 49%) have an internal as well as external network of pores, and are suitable for applications where the carrier is impregnated with a catalyst. Write for Bulletin No. 7, containing additional data on ALUNDUM catalyst carriers.

R_x for more profitable processing

Norton engineered and prescribed refractories are proved aids to better, lower cost production

Backed by over 50 years of experience in electrochemical refining, Norton produces refractories whose purity and properties are carefully controlled and consistently duplicated. These refractories are *engineered and prescribed* to give you the best possible R_x — the most effective combination of physical characteristics, plus thermal, chemical and elec-

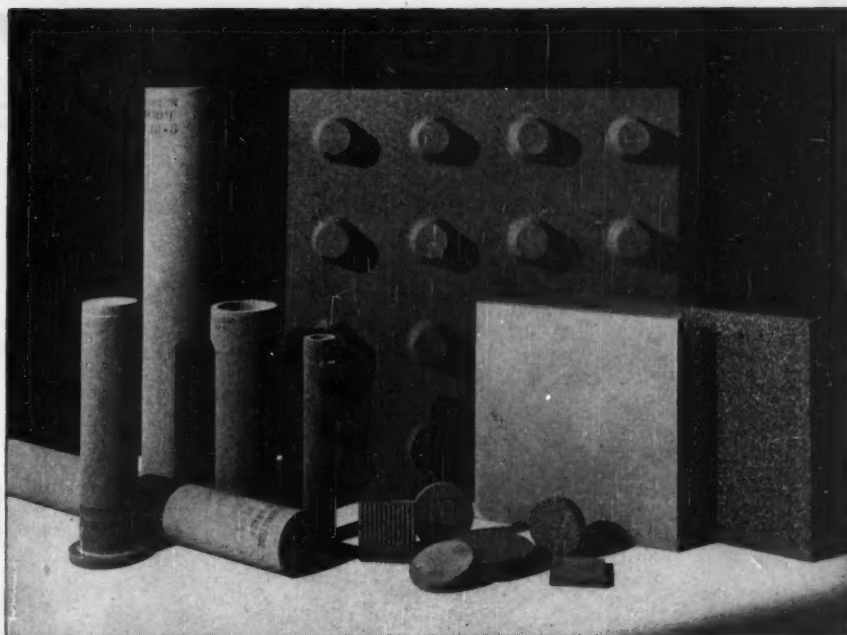
trical properties — for your particular applications.

Chemical engineers are finding these R_x's of immense practical value in widely varying processes. Whatever your own processes may be, it will pay you to learn more about the many advantages of Norton refractories. Just a few products in this complete, top-quality line are de-

scribed here. For complete details, and expert technical aid, call in your Norton Refractories Engineer. Meanwhile, write direct for the illustrated bulletins, mentioned in this advertisement, that cover your requirements. NORTON COMPANY, 504 New Bond Street, Worcester 6, Mass. *Canadian Representative:* A. P. Green Fire Brick Co., Ltd., Toronto, Can.

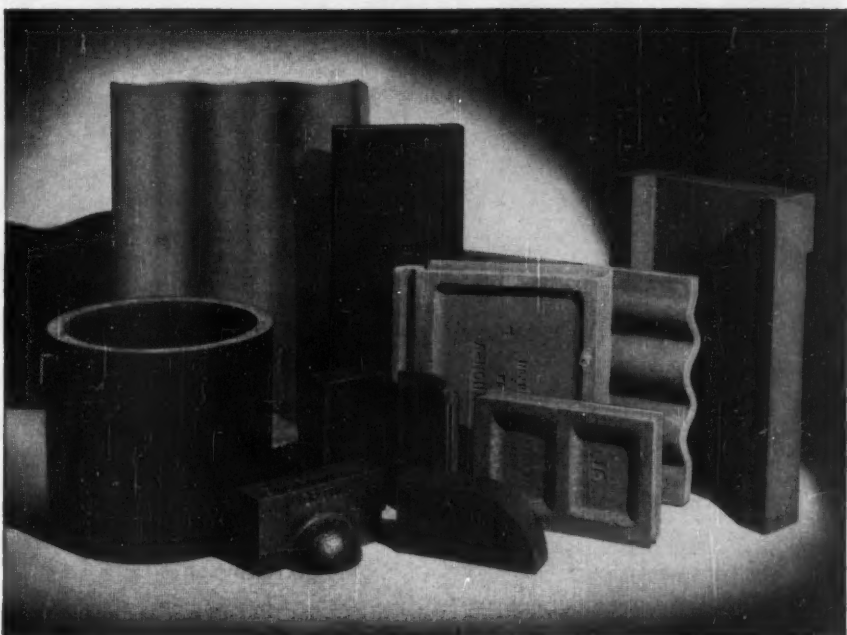
Norton porous mediums come in plates, tubes, discs and diaphragms, engineered to fit your filtering, diffusing or aerating requirements. All have uniform porosity, in the size and open-pore ratio you need. Made of ALUNDUM material that is chemically stable and strong, their resistance both to acid and alkaline conditions gives them extra long life. Norton seamless porous tubes have the advantage, unusual in tubes, of uniform porosity over their entire area — permitting constant air or liquid pressure and enabling uniform backwashing to do more thorough cleaning.

Typical applications are filtering water or solvents; cutting oils, wine and other liquids; reclaiming cleaning fluids; handling industrial oil wastes; chlorination, carbonation and other gas diffusion applications. Bulletin No. 140 tells you more about Norton ALUNDUM porous mediums.



Norton refractory shapes for reaction furnaces come in bricks, plates, tubes and blocks, made of ALUNDUM, CRYSTOLON, MAGNORITE and Fused Stabilized Zirconia refractory materials. The development of Fused Stabilized Zirconia is a typical example of how Norton aids you in utilizing higher temperatures for greater efficiency and output. Norton was the first to bring this valuable material out of the experimental stage into commercial production. Now it is used in many processes.

No other refractory is so chemically stable at such high temperatures under both oxidizing and reducing conditions. In gas synthetic processes, furnaces lined with it have withstood temperatures approaching 4700°F for long periods. Its low thermal conductivity (6.2 BTU in dense shapes at 2000°F) and its high electrical conductivity at high heat are other important properties, all of which are described in Bulletin No. 1741.



Norton electric furnace shapes and laboratory ware

Norton electric furnace refractories — cores, tubes and muffles — are made of ALUNDUM or CRYSTOLON materials. ALUNDUM shapes, composed of 99% pure fused alumina, are characterized by great stability, chemical inertness, excellent thermal conductivity and good electrical insulation qualities. CRYSTOLON shapes, for use under more limited conditions, combine high thermal conductivity with resistance to heat shock. Bulletin No. 458 tells how to construct electrical furnaces for the laboratory.

Norton ALUNDUM laboratory ware, available at your laboratory supply house, offers many properties important to development, experimental or analytical work. It is chemically stable, stands temperatures up to 1900°C and is easy to clean. For filtering, it comes in four degrees of permeability. Bulletin No. 793 gives you the whole story.

NORTON
REFRACTORIES

Engineered... R_x ... Prescribed

Making better products... to make your products better

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries



Dewey & Almy Chemical Co. installation showing 300 GPH Gaulin Homogenizer used for making resin emulsions, shoe cements and adhesive formulations.

Know How a **GAULIN** Homogenizer

**can improve
your emulsions
or dispersions**

Here's what it's doing for others...

PIGMENT DISPERSIONS

Gives a faster, more uniform suspension with less temperature rise.

WAX OR OILS

Makes a smoother, better appearing product. Stops separation.

LATEX & RESINS

Provides more uniform monomer emulsions. Better polymerization control.

COSMETIC EMULSIONS

Improves texture. Boosts shelf-life. Locks perfume in against evaporation.

GREASES

Improves stability and uniformity or simplifies manufacturing. Improves lubricating value and increases service life.

What can it do for you?

Send us a sample of your product today. Our complete testing facilities will give you the answer — without obligation.



GAULIN PILOT PLANT HOMOGENIZER

Ideal for experimental purposes, operation or process requiring up to 25 gallons per hour capacity. Handles quantities as small as one pint. Available on low rental basis.



GAULIN TWO-STAGE COLLOID MILL

Stator is jacketed for cooling or heating. Gap setting adjustable for .001" to .045". Only 45 seconds clean-up required in changing colors. 12" head room. 12" x 17" floor area.



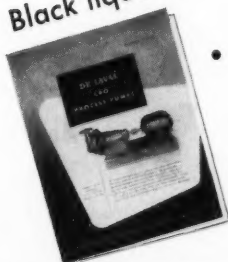
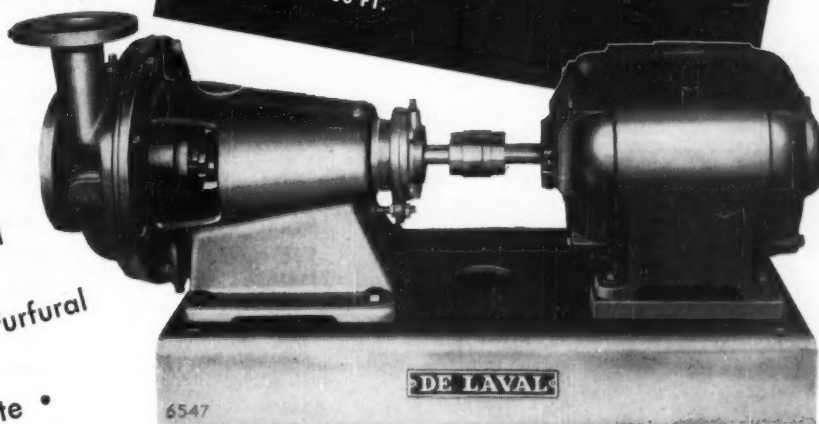
Manton-Gaulin MANUFACTURING COMPANY, INC.

71 GARDEN STREET, EVERETT 49, MASS.

*World's largest manufacturer of Homogenizers,
Triplex Stainless-Steel High Pressure Pumps,
and Colloid Mills*

• Calcium chloride brine • Flushing liquor
 Sodium sulphate • Asbestos fiber & cement mix • Green liquor •
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 • Saturated brine • Grape juice • Tomato juice • Press liquor • Calcium bisulphite • Melt
 Phenolized ammonia • Ammonia liquor • Sulphuric acid • Paraffine oil and water • Sludge
 • Milk waste • Gritty water • Cane syrup • Lime & soda solution • Cachaza • Clear juice
 White water • Mineral oil • Chromic acid
 Brine • Vegetable oil • Licorice liquor •
 • River water • Benzine thinner • Mash
 Methylene chloride • Sodium hydroxide
 Sizing solution • Alcohol •
 • Steep soda • Caustic soda
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*One pump handles
 all these liquids...*
DE LAVAL
CPO PROCESS PUMP
 CAPACITIES TO 2,000 GPM
 HEADS TO 200 FT.



WRITE FOR BULLETIN 1125-B



DE LAVAL *Centrifugal Pumps*

DE LAVAL STEAM TURBINE COMPANY

Nottingham Way, Trenton 2, New Jersey

DL 281

Depend on **LADISH**

Carbon Steels

Carbon-Molybdenum Steels

Chromium-Molybdenum Steels

Nickel Steels

Chromium-Nickel Steels

Chromium-Silicon-Molybdenum

Wrought Iron

Chromium Type Stainless

Chromium-Nickel Stainless

Molybdenum Type Stainless

Wrought Aluminum

Aluminum-Copper Alloys



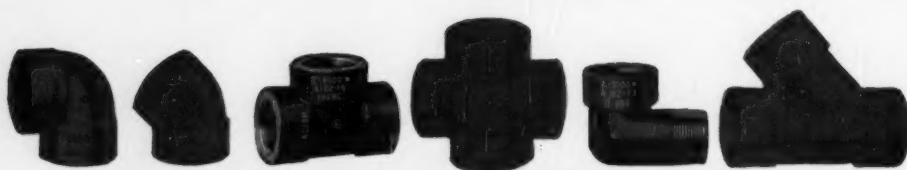
BUTT WELDING FITTINGS

1/2 inch through 42 inches . . .



FORGED CORROSION RESISTANT—LIGHT WEIGHT and A.S.A. FLANGES

1/2 inch through 24 inches . . .



FORGED SCREWED OR SOCKET WELDING FITTINGS and UNIONS

1/8 inch through 4 inches . . .



**LARGE DIAMETER AND T.E.M.A.*
STANDARD FLANGES up to 20 feet O.D.**

**LONG WELDING NECKS
up to 24 inches, 150 lb. through 2500 lb.**

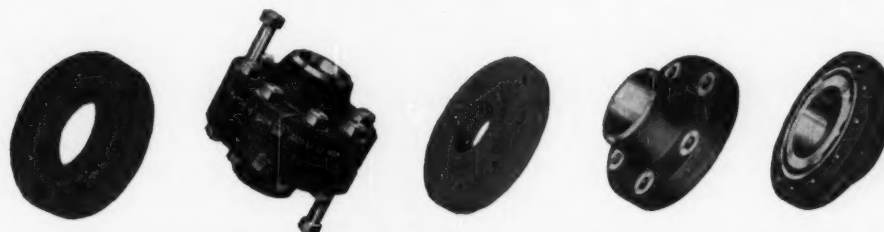
*Tubular Exchanger Manufacturers Association

Complete Service ...



BUTT WELDING FITTINGS

Schedules 5S, 10S, 40S, 80S, and other Schedules and wall thickness.



FORGED CORROSION RESISTANT—LIGHT WEIGHT and A.S.A. FLANGES

150 lb. through 2500 lb. pressure ratings.



FORGED SCREWED OR SOCKET WELDING FITTINGS and UNIONS

150 lb. Corrosion Resistant and 2000 lb. through 6000 lb. ratings.

FOR FITTINGS FROM ANY FORGEABLE MATERIAL TO MEET YOUR SERVICE REQUIREMENTS

You get prompt, efficient service when you specify and order from the complete Ladish Controlled Quality line. Fittings in any forgeable material in virtually every type, size, wall thickness or pressure rating ... are produced to one uncompromising Controlled Quality standard ... and identified with heat code symbols pioneered by Ladish as verification of metallurgical integrity resulting from exhaustive tests made in the Ladish metallurgical laboratories.

For complete service on your fittings requirements, depend on the Ladish line and the services of your Authorized Ladish Distributor.

THE COMPLETE *Controlled Quality* FITTINGS LINE

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TO MARK PROGRESS

Aluminum-Manganese Alloys

Deoxidized Copper

Hastelloy

Titanium

Forging Brass

Everdur Bronze

Silicon Bronze

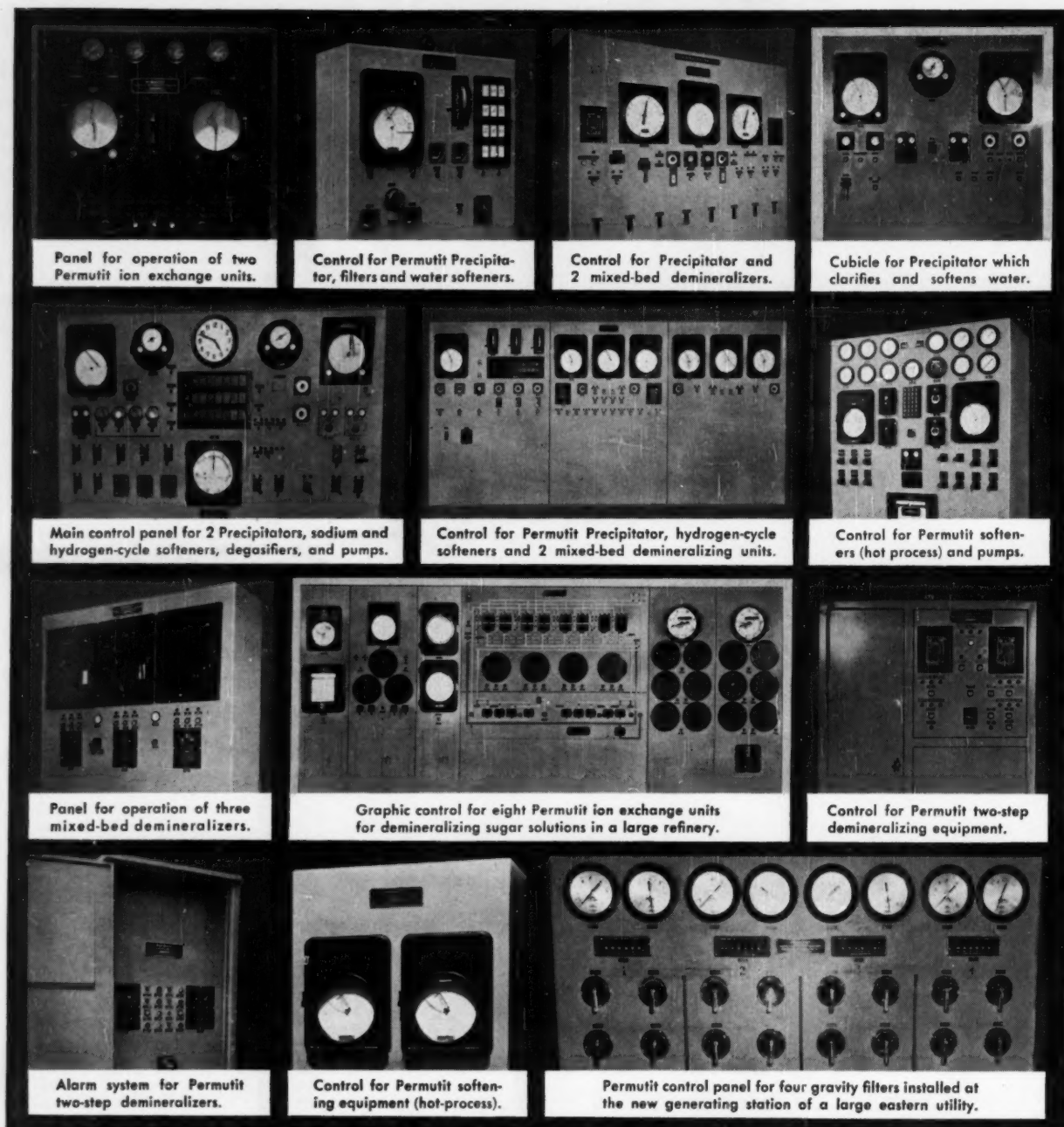
Manganese Bronze

Wrought Nickel

Nickel-Copper Alloys

Inconel

Monel



Why we make our own panels:

Life might be simpler if we "farmed out" our control cubicles and instrument panels . . . but we like to build *every* major component of a PERMUTIT water-conditioning or ion exchange system . . . so that we know it will do its specific job properly.

That's why these panels . . . and the hundreds of others in power plants, chemical process plants, manufacturing plants and municipal water works . . . are designed by Permutit engineers and assembled, wired and piped in Permutit factories.

That's why we design and build our own special parts such as multiport valves, strainer systems and chemical feeders. That's why we make our own ion exchange resins.

As a result, we talk in terms of over-all results. And you get *complete* service from *one* source.

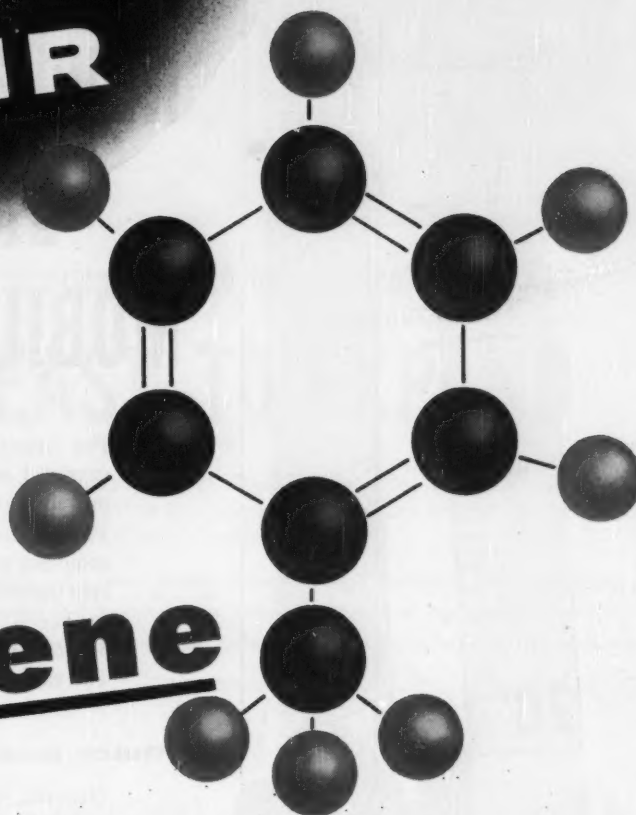
For further information, write to: The Permutit Company, Dept. CE-5, 330 West 42nd St., New York 36, New York.

WATER CONDITIONING • ION EXCHANGE

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now from
SINCLAIR

Toluol
Xylol
Paraxylene



and Heavy Aromatic Solvents

● Do your manufacturing processes call for high-purity aromatic hydrocarbons, including toluol, xylol, paraxylene, and heavy aromatic solvents? If so, Sinclair has the answer to your needs.

Sinclair's newest chemical unit, recently completed at Marcus Hook, Pa., has been especially designed to provide dependable supplies of aromatic chemicals for industry. The operation of this modern Sinclair unit marks another step forward in Sinclair's progress in the petro-chemical field.

Why not investigate this new source of supply *today*? Write or call —

SINCLAIR CHEMICALS, INC.

(Subsidiary of Sinclair Oil Corporation) 600 Fifth Avenue, New York 20, N. Y., Circle-6-3600



important advance in
year-round fire protection

NEW 3% AER-O-FOAM LIQUID MAINTAINS MOBILITY AT -20°F

For control of fires in flammable liquids, 3% foam liquids (double strength) offer obvious advantages: economy of storage space, facility in transport and handling, low cost per unit volume of foam.

The new, patented National *AER-O-FOAM Liquid, 3% Cold Foam*, combines these advantages with the ability to perform as well at sub-zero temperatures as at summer heat.

Unique in its field, this new AER-O-FOAM Liquid assures correct proportioning in the foam-making process at temperatures as low as -20°F . The extra protection is apparent.

Quick facts on performance

National AER-O-FOAM Liquid, 3% Cold Foam, is equally effective with soft, hard, or sea water.

It stores easily for longer periods because there is no deterioration under normal storage conditions.

It is compatible with almost all 3% regular liquids.

It meets all applicable requirements of U. S. Government specifications.

Special Cold-Weather AER-O-FOAM Trucks

For use with 3% Cold Foam Liquid, National Foam offers special foam trucks insulated for operation in very low temperatures. Carrying up to 750 gallons of 3% Cold Foam Liquid, the trucks can produce as much as 12,000 gallons of foam per minute.

Unlimited supply

As a result of recent expansion in National Foam's production facilities, the new 3% Cold Foam Liquid is available in unlimited quantities. Full details will be forwarded promptly on request.

NATIONAL FOAM



SYSTEM, Inc.
West Chester, Pa.



ENGINEERING
REPORTS:

G-E electrical systems for chemical plants are . . .

EASY TO EXPAND

Easy to expand General Electric electrical systems will help make modernization or expansion programs in chemical plants more economical. Here's why:

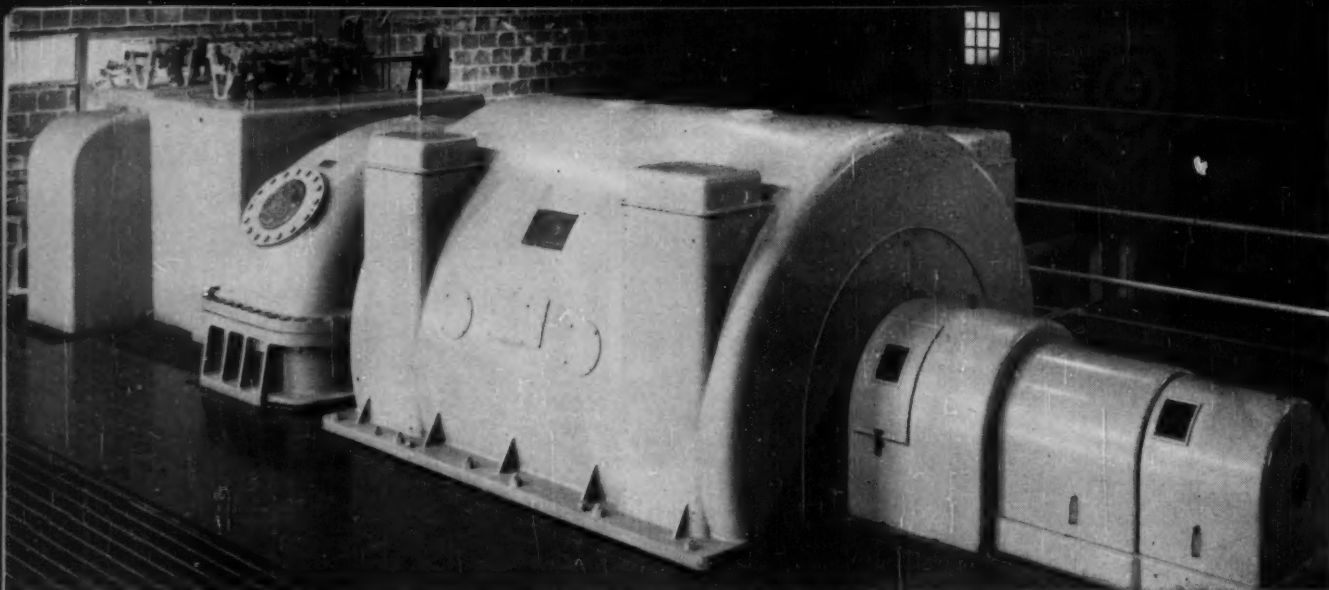
- Flexible G-E system design simplifies the addition of new equipment.
- Versatile G-E equipment is easily incorporated into existing system.
- Experienced G-E engineers help plan, co-ordinate, and install system.

To learn more about these systems, equipment, and engineering services turn to the following pages.

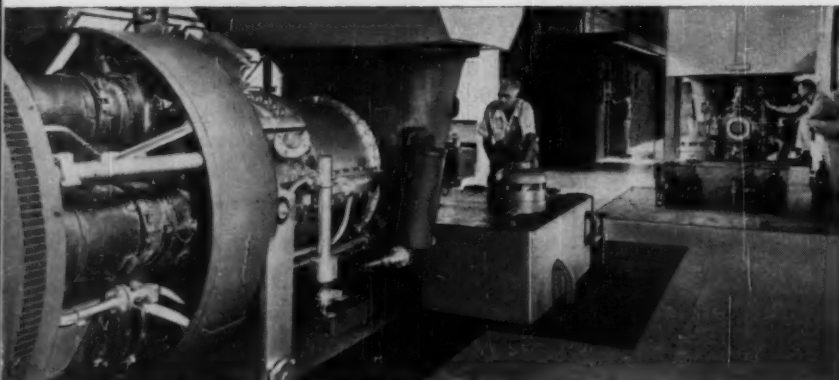
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MORE EFFICIENT ELECTRICAL SYSTEMS ►

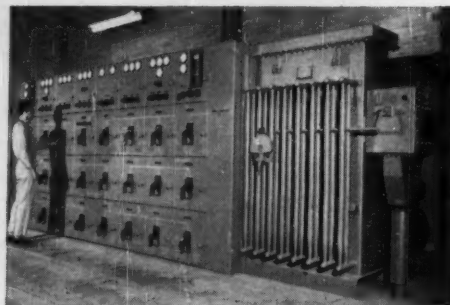
GENERAL  **ELECTRIC**



UTILIZING PROCESS STEAM, G.E.'s complete range of steam turbine-generators provide electric power as a by-product, help maintain plant steam balance.



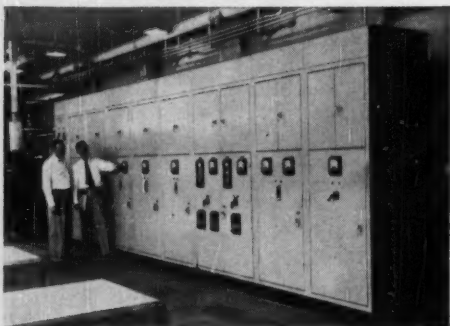
DEPENDABLE G-E gas turbines range from 6700 to 1700 hp. More than 55 units utilize exhaust heat for power generation and mechanical drive applications.



FACTORY ASSEMBLED G-E load center unit substations help cut installation time.



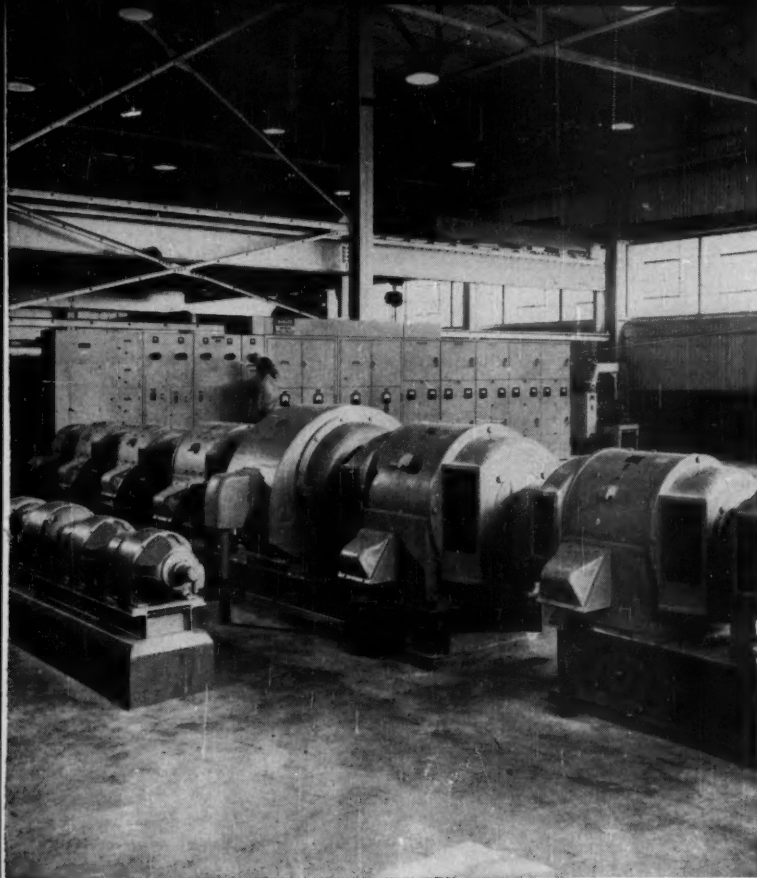
COMPLETE, COMPACT, G-E motor control centers provide centralized control in load areas.



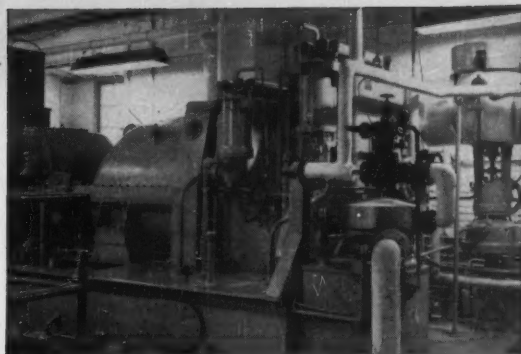
SAVE FLOOR SPACE with compact G-E Limit-amp control units.



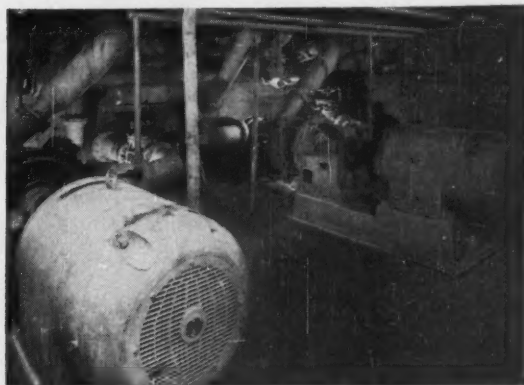
MORE RELIABLE POWER DISTRIBUTION is available with G-E package substations which use co-ordinator transformers, metal-clad switchgear.



DEPENDABLE G-E d-c motor generator sets are designed to operate in continuous service at top efficiency. Minimum of maintenance is a key feature of these sturdy generators built for long life.



ECONOMICAL MAINTENANCE is a key feature in design of G-E mechanical drive turbines.



RUGGED CONSTRUCTION of G-E Tri-Clad* motors make them ideal for all types of drive operations. Polyex insulation in motors 100-3000 hp gives 50% longer motor life.
*Reg. Trademark of General Electric Co.

G-E engineering services, equipment can give you . . .

More efficient electrical systems

MODERNIZING, EXPANDING, BUILDING? Whatever your plans, let experienced G-E engineers help plan a more efficient electrical system for you. They will work with you or your engineering contractors to give you correct answers to the following questions.

SHOULD YOU GENERATE OR PURCHASE POWER? G-E engineers will help make a "load" survey of your facilities, and recommend an economical solution to your particular power supply problem.

WHAT TYPE ELECTRICAL DISTRIBUTION SYSTEM SHOULD YOU INSTALL? The latest distribution system concepts will be reviewed with you by G-E engineers. They will help select and design a modern system to meet your individual requirements.

WHAT KIND OF DRIVE EQUIPMENT SHOULD YOU USE? Each application for drives in your processing lines will be individually examined by G-E engineers to assure that the proper drive is designated for the job.

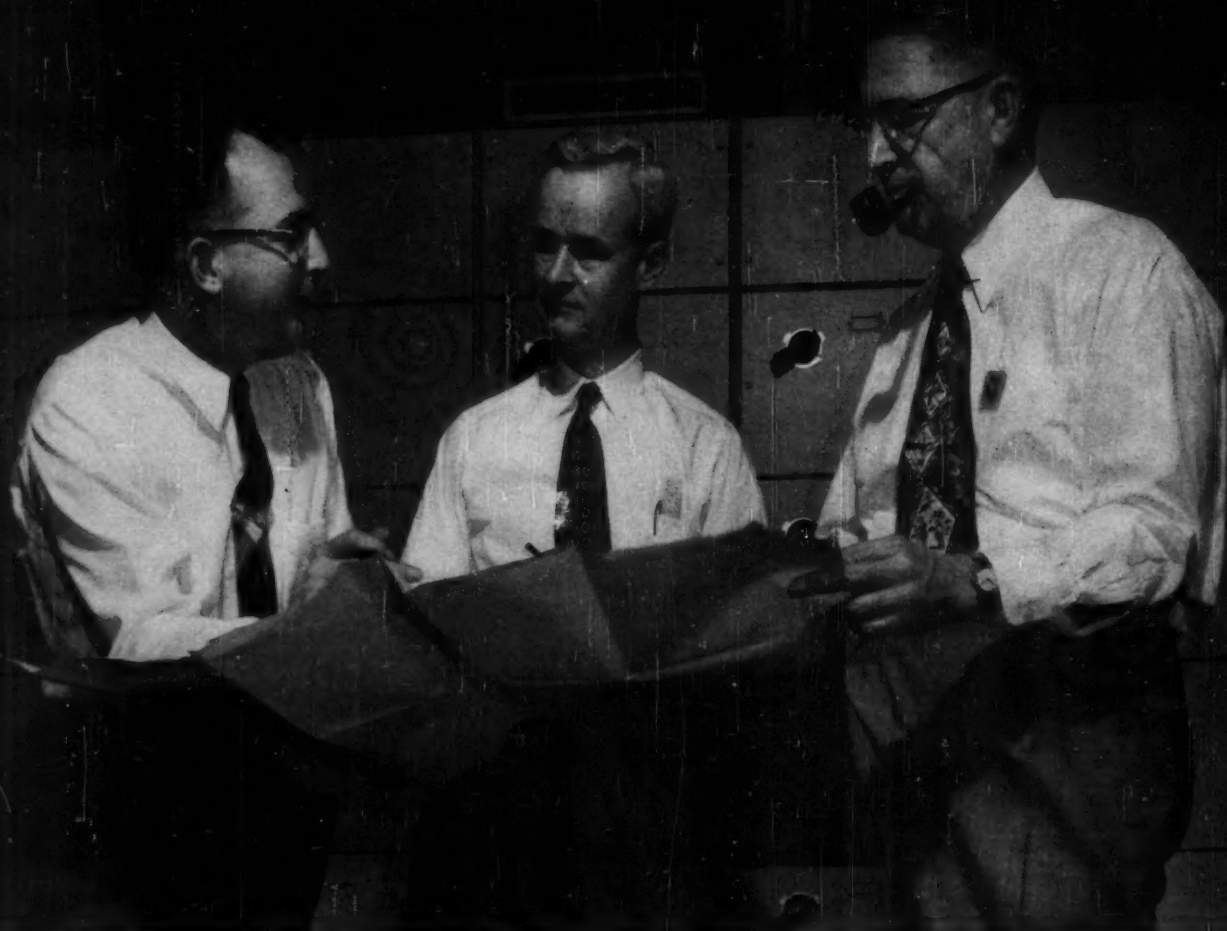
WHERE CAN YOU UTILIZE AUTOMATIC CONTROLS? New developments in the field of automatic controls will be applied throughout your processing lines by G-E engineers.

Let your General Electric Apparatus Sales Representative get you detailed answers to these and other electrical questions. Contact him at your nearest G-E Apparatus Sales Office early in your planning stages: General Electric Company, Schenectady 5, N. Y. 681-3

PROTECT YOUR EQUIPMENT INVESTMENT ►

Engineered Electrical Systems for Process Industries

GENERAL  **ELECTRIC**



SIX G-E ENGINEERING SERVICES . . .

HELP YOU PROTECT YOUR EQUIPMENT INVESTMENT

1 G-E APPLICATION ENGINEERING helps you and your consultants design the right electric system for your plant.

2 G-E ANALYTICAL ENGINEERING helps attain the optimum electrical system for your application. Engineering experience backed up by electronic system analyzers save valuable design time.

3 G-E PRODUCT DEVELOPMENT laboratories design and test new equipment under tomorrow's conditions to meet your future demands.

4 G-E FIELD-SERVICE ENGINEERING helps you supervise installation, expedite start-up of your major electric equipment.

5 G-E MAINTENANCE SERVICE from 31 G-E Service Shops will repair and uprate your old equipment, help establish productive maintenance of your equipment, furnish emergency service.

6 G-E PROJECT CO-ORDINATION means on-time engineering, shipment, installation of your electric equipment from preliminary diagrams through start-up.

These valuable services are available to you with General Electric equipment. Contact any General Electric Apparatus Sales Office. Meanwhile, for the full story of G-E engineering services, write for brochure GED-2244, General Electric Co., Sect. 681-3, Schenectady 5, N. Y.

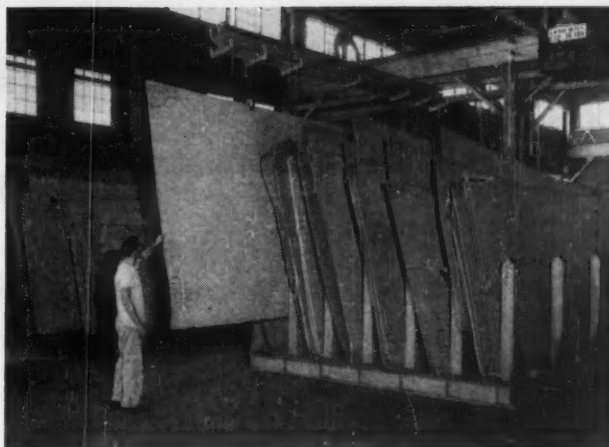
Progress Is Our Most Important Product

GENERAL  ELECTRIC

\$
save
on
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stainless

**...with a sure
Source of Supply**

You can be sure of economy and efficiency when you place your order for stainless steel with G. O. Carlson, Inc. Skilled craftsmen working with the finest equipment produce stainless steel plates to the highest chemical industry standards and deliver them to you *on time*.



STAINLESS STEEL PLATES rolled to almost any size or thickness, $\frac{3}{16}$ " and heavier, solid or clad, or cut to your individual requirements—whether rectangles, circles or special patterns. Large tonnage of HRAP finished plate carried in stock for prompt shipment. Illustration shows one of our many plate storage racks.



STAINLESS STEEL HEADS press formed or spun in a wide range of sizes and gauges to ASME and Standard specifications. A portion of the stainless steel heads storage is shown above.

STAINLESS STEEL FORGINGS and SPECIAL PATTERNS—Specialized equipment provides flexibility in the production of flanges, circles, rings, sketch plates and other specialties cut or machined from plate, or forged and rough machined.

Also STAINLESS STEEL BARS and SHEETS (No. 1 Finish)

Write for Carlson Weekly Stock Lists.
Call on us for complete information
about Carlson's services in stainless steel.

G. O. CARLSON, INC.
Stainless Steels Exclusively
Plates • Plate Products • Forgings • Bars • Sheets (No. 1 Finish)
THORNDALE, PENNSYLVANIA
District Sales Offices in Principal Cities

WHAT'S NEW AT BRISTOL

FIRST instrument system BASIC GRAPHIC-PANEL

It's BRISTOL'S new metagraphic instrument system

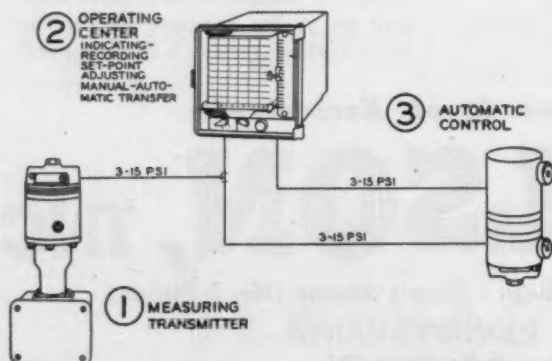
A WIDE SELECTION: For example, there are 35 receiver and 34 controller models and the widest variety of transmitters on the market. A model can be found among these that will exactly meet any requirement.

FULL PLUG-IN SERVICE: Change recorder to an indicator or vice versa in 10 seconds with ABSOLUTELY NO INTERRUPTION WHATSOEVER TO AUTOMATIC CONTROL.

Pull complete chassis out (one piece chassis — no tools required). With chassis removed you get the same automatic control as before.

Change from one model to another or if trouble is suspected in a plug-in unit, the doubtful unit can be replaced by a spare while the suspected unit is checked in the service shop — out-of-service time is thus eliminated.

CONTINUOUS VALVE POSITION INDICATION on same instrument scale as set point scale, gives continuous data on control valve position — makes "bumpless" transfer possible, simply by matching pointer positions — no need to read actual scale values — minimizes reading errors — speeds operations.



METAGRAPHIC TRANSMITTER

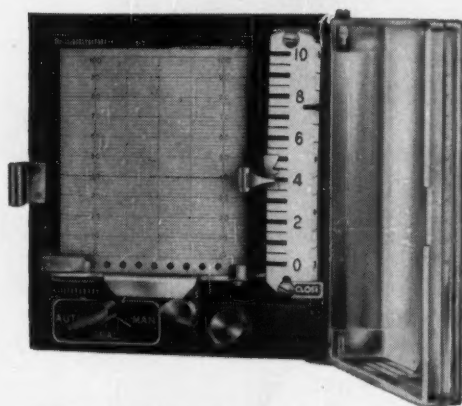
SUPPLIED IN A VERY WIDE VARIETY OF SPANS AND RANGES: For example, absolute pressure instruments are made in ranges as low as 5mm mercury absolute. Pressure instruments as low as 5 inches water to 10,000 psi. Over-range protection available up to 400% over range.

STANDARD BRISTOL MEASURING ELEMENTS ARE USED — high torque, wide-angle travel gives powerful, positive operation. Very sensitive — as little change as 0.03% of range, including reversal.

METAGRAPHIC INSTRUMENTS MEASURE, RECORD, INDICATE, AND AUTOMATICALLY CONTROL

Pressure	Liquid Level
Vacuum	Flow
Absolute Pressure	Temperature and
Differential Pressure	Mechanical Motion

that carries out idea completely!

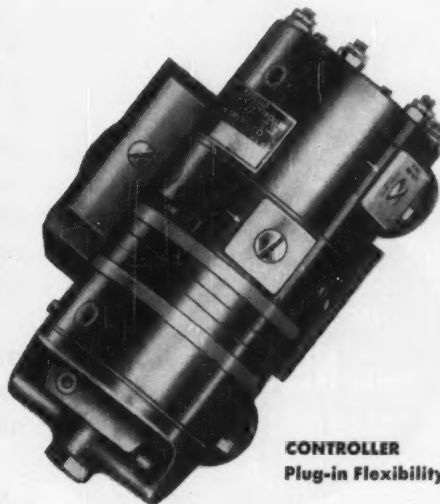


RECORDING RECEIVER:
Also furnished as an Indicator

NO INTERRUPTION WHATEVER TO AUTOMATIC CONTROL when receiver chassis is removed. The chassis of a Metagraphic Receiver is plug-in construction and can be changed from a recorder to an indicator or back in a matter of 10 seconds.

OFFERED FOR UP TO 3 MEASURED VARIABLES — with air pressure regulators or air-loaded regulators — three-position manual-automatic transfer valves for automatic control and *six-position (on the same knob) transfer valves for cascaded control.*

ALL MEASUREMENTS ON SAME SCALE PLATE: Deviation of pointers shows at a glance conditions of control — no need to read scale.



CONTROLLER
Plug-in Flexibility

VARIETY AND FLEXIBILITY: The most flexible and complete line of controllers offered — 34 different models, including the following variations:

1. Remote set-point
2. Integral set-point (with or without air-loading)
3. Pipe-connected
4. Plug-in receiver mounted
5. Plug-in pipe or surface mounted
6. Five models of control action as follows:
 - a. On-Off
 - b. Adjustable proportional
 - c. Adjustable proportional plus reset
 - d. Fixed proportional plus reset
 - e. Proportional plus reset plus rate (derivative)

Write for our product data sheets. The Bristol Company, 109 Bristol Road, Waterbury 20, Conn.

6.5.2

BRISTOL

**POINTS THE WAY IN
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AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

CHEMICAL ENGINEERING—May 1955

REMOTE
DIALED WEIGHT
SELECTION BELONGS
IN YOUR BUSINESS
THIS **NEW FREE** BOOK
TELLS THE FULL STORY
OF



RICHARDSON **SELECT-O-WEIGH**®

REMOTE WEIGHT SETTING SYSTEMS

Here are answers to the puzzlers you've had about completely automatic weighing, proportioning and blending. Richardson's new 28-page booklet shows in detail how industries like yours use Select-O-Weigh systems to "dial" as many as 20 individual ingredient weights in formulas.

Many industrial "case histories" and over fifty easy-to-understand diagrams and illustrations take you through Richardson's material-saving, time-saving, labor-saving story of finger-tip formulation which requires no manual changes, even

for fractional proportions. Send for this free booklet today. See how a Select-O-Weigh system—developed out of Richardson's 50 years of experience in building automatic weighing, proportioning and blending equipment—can solve countless problems in your change-over from conventional weighing and proportioning methods to automation.

Write today for your free copy of Bulletin 0351.



RICHARDSON SCALE COMPANY Clifton, New Jersey

Atlanta • Boston • Buffalo • Chicago • Cincinnati • Detroit
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Richardson

MATERIALS HANDLING BY WEIGHT SINCE 1902

1448

FAMOUS LIGHTHOUSES OF AMERICA



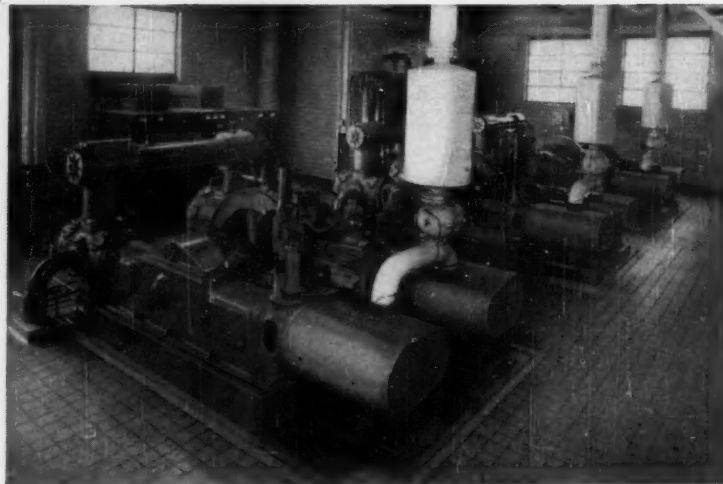
MINOT'S LEDGE LIGHT, one of America's most famous wave-swept lighthouses, guards ships against treacherous reefs 6½ miles southwest of the entrance to Boston Harbor. The first tower at Minot's Ledge, an openwork iron pile structure completed in 1850, was toppled into the sea by a great storm in 1851. The second tower, built of interlocking granite blocks and completed in 1860, still stands solidly on the ledge.

A familiar beacon and safe guide to quality in electrochemicals is the name Niagara Alkali Company, long recognized as a leader in this field of chemical production. Depend on Niagara for quality and good service in Nialk® Liquid Chlorine, Nialk Caustic Potash, Nialk Carbonate of Potash, Nialk Paradichlorobenzene, Nialk Caustic Soda, Nialk TRICHLORethylene, Niagathal® (Tetrachloro Phthalic Anhydride).

NIAGARA ALKALI COMPANY

60 East 42nd Street, New York 17, N. Y.

DON'T LET OFF STEAM !



Put it to work with a Class H Compressor

If you can use exhaust steam economically, you can reduce compressed air costs with a dependable CP horizontal duplex Class H steam-driven Compressor. Equipped with steam cylinders properly proportioned to your steam conditions . . . throttling type governor or automatic cut-off for peak economy over a wide range of load . . . and Simplate valves, the Class H affords high economy in pounds of steam consumed per unit of air delivered. Capacities range from 900 to 7,400 cfm. (100-125 lb. air, 200 to 1,250 hp.) Other types and sizes available for lower or higher pressures. For details write *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, N. Y.*


Chicago Pneumatic

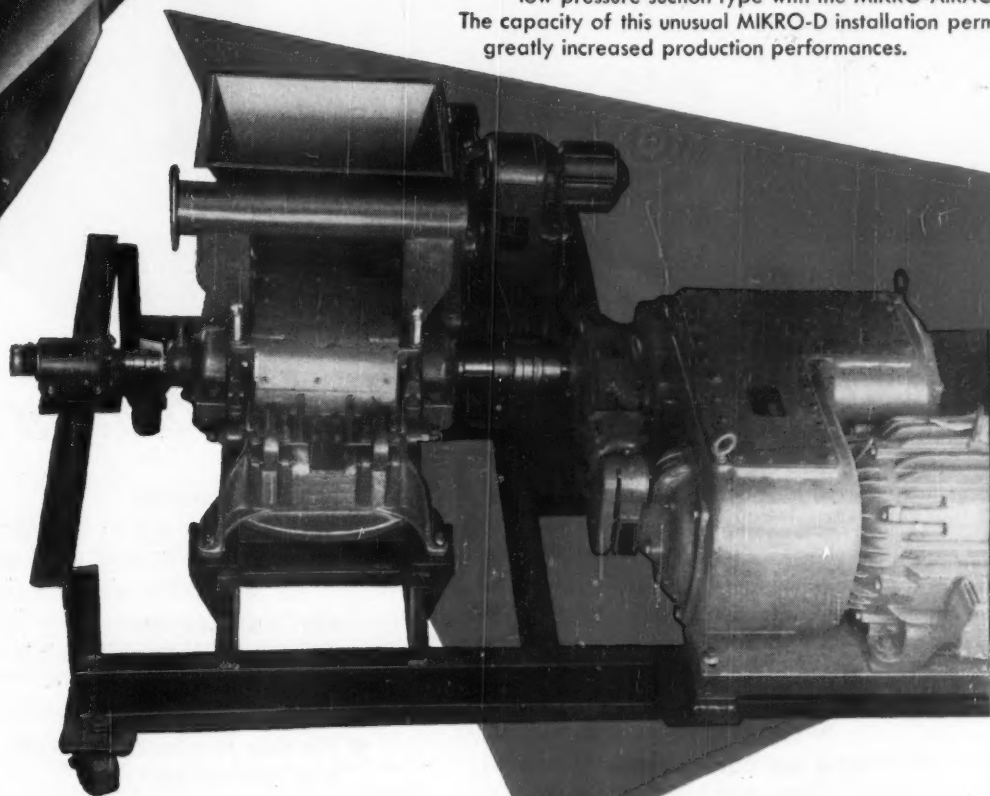
PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

MIKROS help process materials for rocket fuel

Two big MIKRO-PULVERIZERS, of the direct drive type have been installed in a large chemical plant for use in the processing of potassium perchlorate used in rocket fuel.

The significant feature of this unusual installation is the inclusion of special devices such as tachometers, for remote control in the handling of a material which is hygroscopic and highly explosive. The two units, with a capacity of 3,000 pounds per hour, are vented by MIKRO-COLLECTORS of four filter cylinder capacity.

The installation also includes air-conveying of the low pressure suction type with the MIKRO-AIRACON. The capacity of this unusual MIKRO-D installation permits greatly increased production performances.



Mikro-D
PULVERIZER

SEND FOR descriptive illustrated bulletin

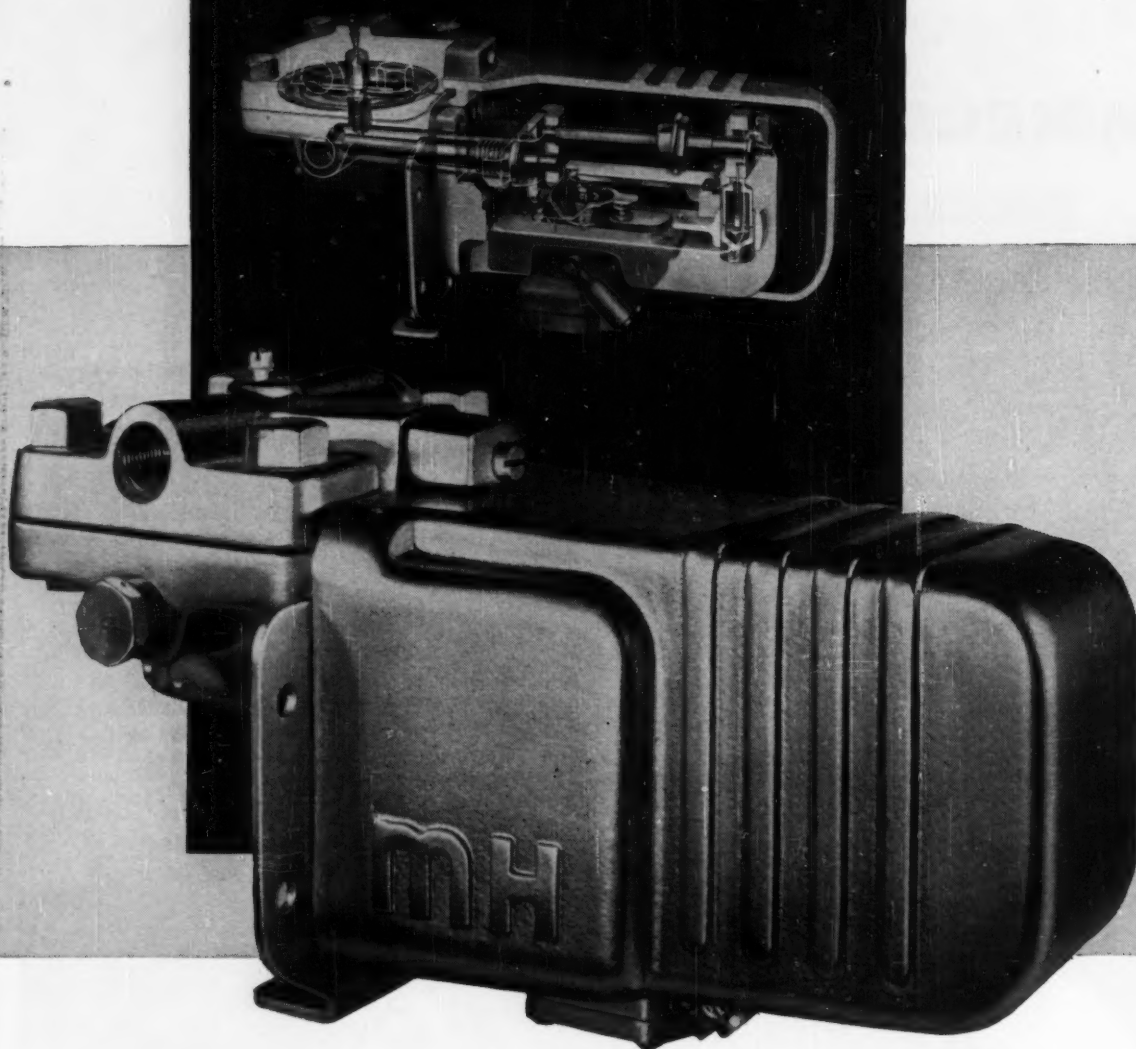
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METALS DISINTEGRATING COMPANY, INC.

55 CHATHAM ROAD

SUMMIT, NEW JERSEY

3017

PULVERIZING • AIR CONVEYING • DUST COLLECTING EQUIPMENT



Every feature your application requires!

CONTINUOUSLY ADJUSTABLE RANGE

Easy field adjustment of range
from 0-20 to 0-200 inches of water.

SIMPLE DESIGN

Uses no mercury . . . has few moving
parts . . . practically no maintenance.

SIMPLE FIELD CALIBRATION

Check with weights in minutes . . .
no curves or tables. 1 lb.=10" water.

LOW AIR CONSUMPTION

Model with pilot relay uses
only 0.05 cfm of air.

HIGH SPEED

Practically instantaneous response
to changes in flow or level.

HIGH TEMPERATURES

Withstands fluid temperatures up to 350°F
. . . ambient temperatures to 225°F.

RESISTS CORROSION

Teflon diaphragm and stainless steel
meter body eliminate usual need for
seals or purges.

EASY INSTALLATION

Compact, lightweight unit is
easily mounted anywhere.

● **Plus these new features for liquid level measurements:**

LOWER RANGES

Extended down to 0-14 inches of
water for liquid level applications.

VERSATILE CALIBRATION

Direct-reading scale, with up
to 100% suppression of calibrated
range.

**Pace-setting performance
for flow measurements—
*now for liquid level, too!***

the Honeywell
Differential Converter

THE remote transmitter that has set new standards of performance in flow applications—the Honeywell Differential Converter—is now available in a new model for liquid level measurements in closed vessels. Suitable for use with either pressure or vacuum vessels, this model offers all the features of fast response, precision, convenience and ruggedness that have earned the Differential Converter wide acceptance throughout industry. The line now covers practically *any* flow or liquid level measurement.

This versatile pneumatic transmitter uses no mercury. It can be used in scores of installations where contamination problems have long impeded measurement. Operating on the force-balance principle, it provides exceptional precision and high-speed

response . . . makes possible closer control in the most critical applications.

The ideal companion for Honeywell *Tel-O-Set* miniature indicators, recorders and controllers, the Differential Converter can transmit to any of a variety of Honeywell instruments.

Whenever you have a flow or liquid level measuring problem, you'll find the Differential Converter offers you the top in performance and serviceability. Your nearby Honeywell sales engineer will be glad to discuss your requirements in detail. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO.,
Industrial Division, Wayne and Windrim Avenues,
Philadelphia 44, Penna.

● REFERENCE DATA: Write for Bulletin 2291, "Differential Converter Liquid Level Transmitter", and for Bulletin 1160, "Measuring and Controlling Liquid Level."



MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS

First in Controls

A.O. Smith for

VESSELS

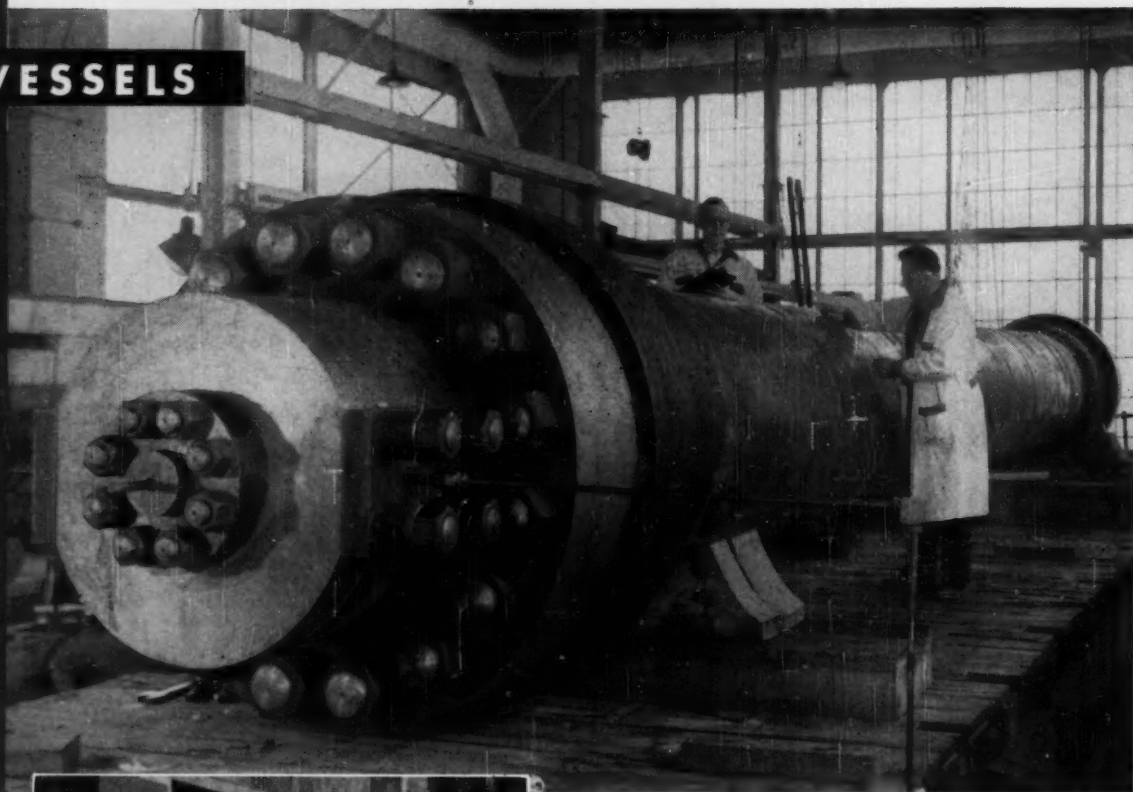
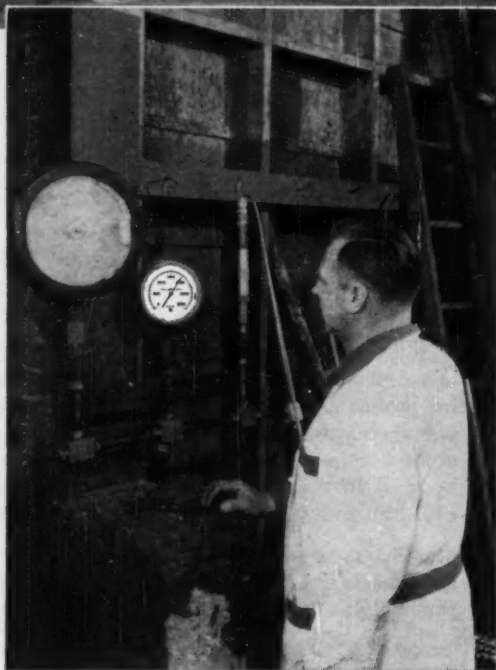


Photo shows MULTI-LAYER ammonia super-pressure converter on test at A. O. Smith. Inside vessel diameter is $25\frac{3}{8}$ in. . . . length from one flange face to the other is 44 ft. 3 in. . . . weight 238,000 lbs. Vessel is designed for operating pressures of 12,500 psi at a temperature of 450° F.



A. O. Smith technician checks gauges on converter undergoing pressure tests. The giant vessel is being tested out at 18,750 psi.

If your process involves high

DESIGN

THE ANSWER TO THE HIGHER PRESSURES WITH SAFETY

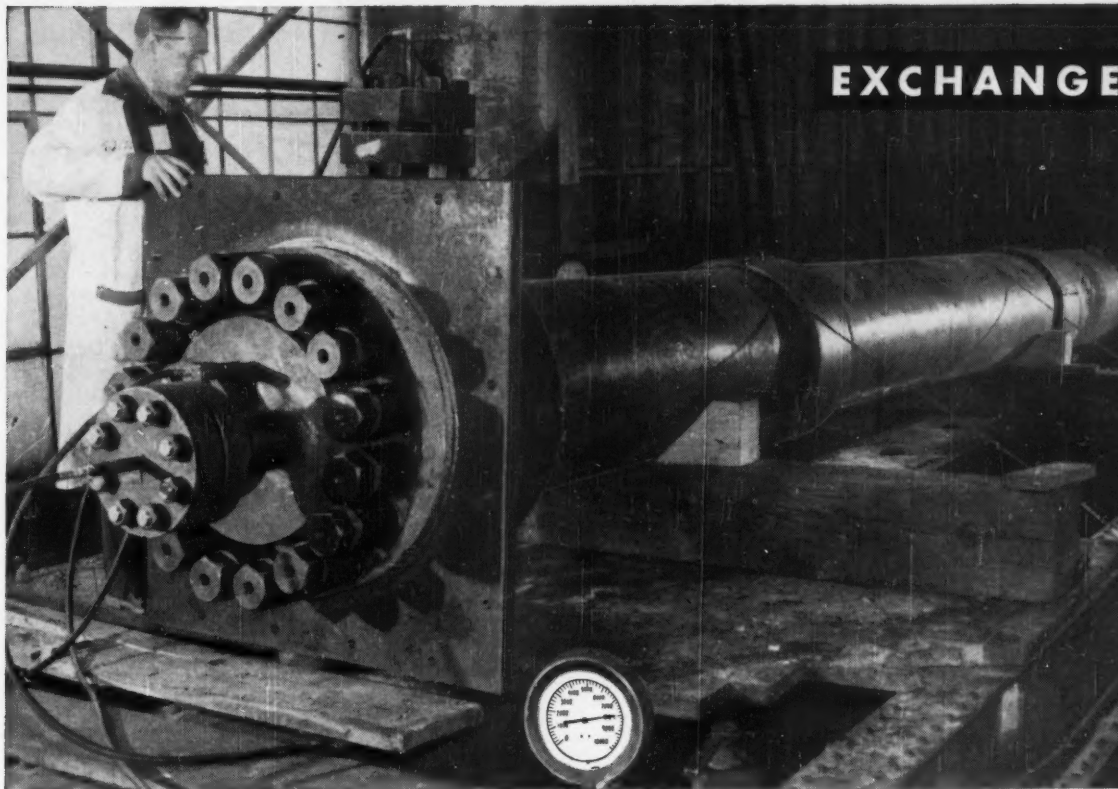
A. O. SMITH MULTI-LAYER construction offers significant advantages to the men who operate plants or design equipment for the processing industries. Today . . . right now . . . they can design for the higher pressures that will be required in the future.

In MULTI-LAYER construction, successive concentric layers of relatively thin steel plate are wrapped and welded around a central pressure-tight cylinder. There's no limitation of size or weight . . . no restrictions imposed by ingot size or forming techniques. The variations are endless.

Positive safety under pressure, too! By testing to destruction full-scale vessels at pressures in excess of

Outstanding Advantages

EXCHANGERS



Here's a Multi-LAYER recycle heat exchanger undergoing test pressure of 7,920 psi. Inside diameter is 17 in. . . . MULTI-LAYER wall thickness is $3\frac{3}{8}$ in. . . . overall length 29 ft. 2 in. Weighing 31,200 lbs., this exchanger is designed for shell-side operating pressures of 5,280 psi.

pressures, high temperatures or corrosive materials, WITH MULTI-LAYER

40,000 psi, A. O. Smith has proved that MULTI-LAYER vessels burst without fragmentation.

Pick the alloy lining required to fit your needs! MULTI-LAYER vessels can be fabricated with inner cylinder of lined or clad plate, alloy steel or non-ferrous materials. The outer layers of the vessel can then be fabricated of high strength steel to resist the pressure loads.

Let A. O. Smith engineering and research help you adapt MULTI-LAYER vessels and heat exchangers to your operation.

Write for free bulletins: "MULTI-LAYER Manufacturing and Assembling" . . . "MULTI-LAYER Engineering for Safety."

Through research



... a better way

A.O. Smith
CORPORATION

PROCESS EQUIPMENT DIVISION

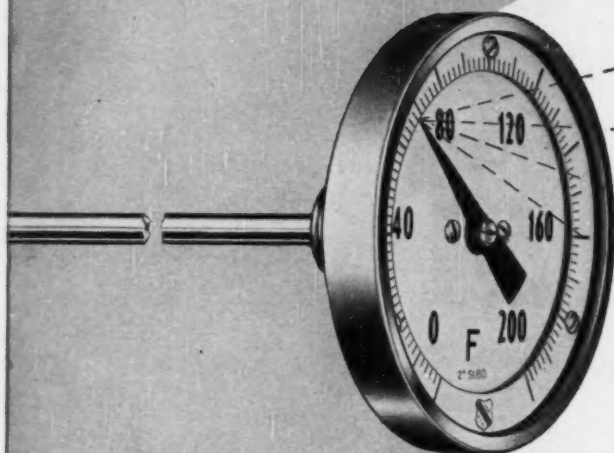
International Division: Milwaukee 1, Wis.

MILWAUKEE • HOUSTON • LOS ANGELES

For glass-lined process equipment, contact GLASCOTE PRODUCTS, INC., Cleveland 17, Ohio — A new A. O. Smith Subsidiary

ANTI-PARALLAX MAXIVISION

is yours in this
new thermometer



Now you can read temperatures *right at the process* with the same ease, accuracy and economy as pressure readings. The Anti-Parallax Maxivision Dial on this new all stainless steel American Bi-Metal Thermometer assures these important advantages. The large, easy-to-read black figures and graduations are carried on a raised ring set close to the glass, with pointer at the same level. Parallax error is practically eliminated.

With this new thermometer in service, field operators can eliminate frequent trips to the control house to observe process changes. Indoors or outdoors, this fine, all stainless steel American instrument is truly climate-proof. Because the case is only 3" in diameter, the thermometer fits where space is limited. Ample clearance behind the case makes installation easy and fast with a small wrench. Read the specification highlights, then get full details about this new high-accuracy American Bi-Metal Thermometer.



PHONE your Industrial Supply Distributor for prompt attention to your needs. He is always ready to help keep your production going by making fast delivery from local stocks.

AMERICAN INDUSTRIAL INSTRUMENTS



A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONNECTICUT

MAKERS OF 'ASHCROFT' GAUGES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, Stratford, Conn. HANCOCK VALVES, Watertown, Mass. 'CONSOLIDATED' SAFETY RELIEF VALVES, Tulsa, Oklahoma. AIRCRAFT CONTROL PRODUCTS, Danbury & Stratford, Conn. and Inglewood, Calif. "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, Muskegon, Mich.

SPECIFICATIONS

New AMERICAN ALL-STAINLESS STEEL BI-METAL THERMOMETER with ANTI-PARALLAX MAXIVISION DIAL

Dial: Exclusive anti-parallax Maxivision dial, with scale approximately 6" long. Pointer set at same level as scale.

Climate-Proof Case: All stainless steel. 3" diameter. Threaded bezel. Selected clear, extra-heavy cover glass. Heat-resistant gaskets between glass and case seal the thermometer against rain, frost, sand, dust, fumes—climate-proof.

Temperature Ranges: From minus 80° to plus 1000° F. Accuracy within 1% of range.

Low-Mass Bi-Metal Coil: Welded to stem plug. Accurately centered in stem. Non-freezing, non-corrosive silicone fluid on coil dampens vibration, accelerates heat transfer, speeds response; does not gum, resists capillary action.

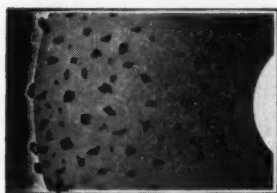
Pointer: Index type. Easily accessible from front of dial for positive adjustment over entire range. Pointer shaft guided by friction-free bearings.

Stem: 18-8 stainless steel, mirror polished. All joints welded. Resists corrosion. Provides strong, rigid and tight closure against process pressures. Lengths: 2½" to 24".

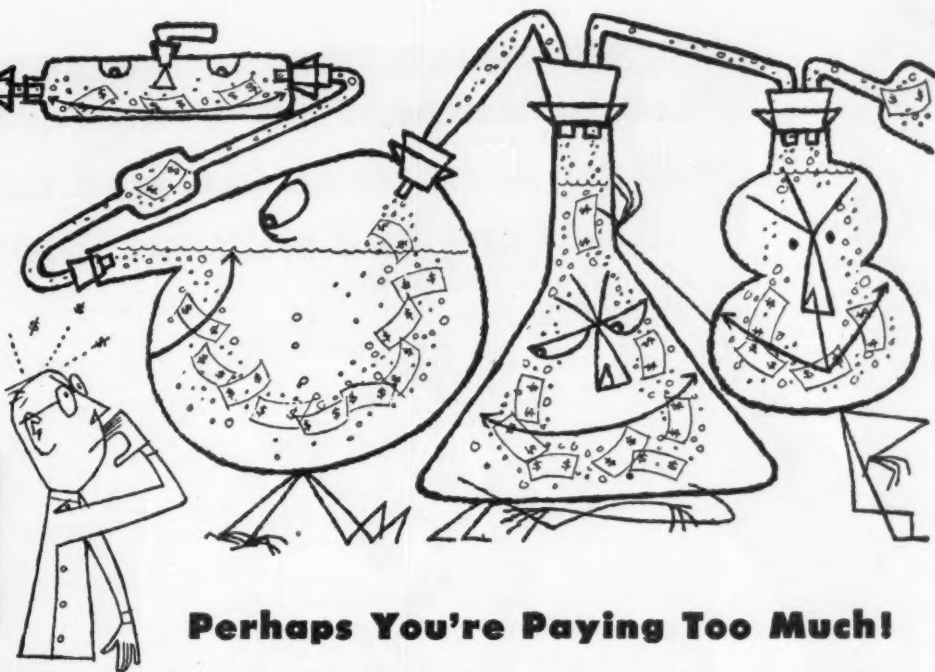
Connection: Fixed, ½" N. P. T.

Separable Sockets: Available for use in closed systems or where measured medium is corrosive to the stainless steel stem. Fit over all standard stem lengths except 2½".

**HOW MUCH
IS IT WORTH
TO YOU...
TO GET
PROCESS FLUIDS
CLEAN?**



*10, 25, 50 micron densities available
MICRO-KLEAN cartridges fit other
makes; special lengths available for
built-in installations.



Perhaps You're Paying Too Much!

Sometimes, it's worth a lot. You'll go to any expense to remove contamination.

But—in hundreds of cases, chemi-

cal firms are getting perfectly satisfactory results with the less expensive Cuno MICRO-KLEAN replaceable-cartridge filter.

SO YOU HAVE TO ASK YOURSELF . . .

1. Will the MICRO-KLEAN do my job well enough?

To help you answer: Cuno MICRO-KLEAN is guaranteed to remove all solids larger than specified* plus a large proportion down to 1 micron.

2. How much will the MICRO-KLEAN save me?

Well, the savings come from:

a. Lower initial cost

b. Lower maintenance cost—housing easily disassembled for cleaning—filter renewed by simple replacement of cartridges.

c. Lower replacement cost—MICRO-KLEAN's exclusive construction assures double life.

d. Positive mechanical separation—cartridge cannot shrink, swell, channel, or distort—fluid is protected.

INVESTIGATE MICRO-KLEAN NOW!

This well-proved filter handles wide ranges of fluids at wide ranges of flow

rates and viscosities . . . capacities from a few to over 800 gpm . . . connections from 3/8 in. IPS to 6 in. flanged.



Complete Line

ENGINEERED FILTRATION

If you can pump it,
Cuno can filter it

MICRONIC (Micro-Klean) • DISC-TYPE (Auto-Klean) • WIRE-WOUND (Flo-Klean)

WHAT'S YOUR CLEANING PROBLEM? SEE IF MICRO-KLEAN WON'T SOLVE IT FOR A FRACTION OF THE COST

- ☐ Absorption oils
- ☐ Cellulose acetate
- ☐ Chlorinated solvents
- ☐ Coal tar solvents
- ☐ Enamels
- ☐ Ethylene glycol
- ☐ Ethyl and methyl cellulose

- ☐ Glacial acetic acid
- ☐ Helium
- ☐ Industrial alcohols
- ☐ Lacquers
- ☐ Natural gas
- ☐ Nitrogen
- ☐ Paraffin

- ☐ Petroleum solvents
- ☐ Photographic developing solutions
- ☐ Pickling brines
- ☐ Sulphuric acid (up to 12%)
- ☐ Varnishes
- ☐ Water and water solutions

CUNO ENGINEERING CORPORATION Dept. 102
102 South Vine Street, Meriden, Conn.

Please send me a free copy of your MICRO-KLEAN bulletin. I am especially interested in the services checked.

Name.....Title.....

Company.....

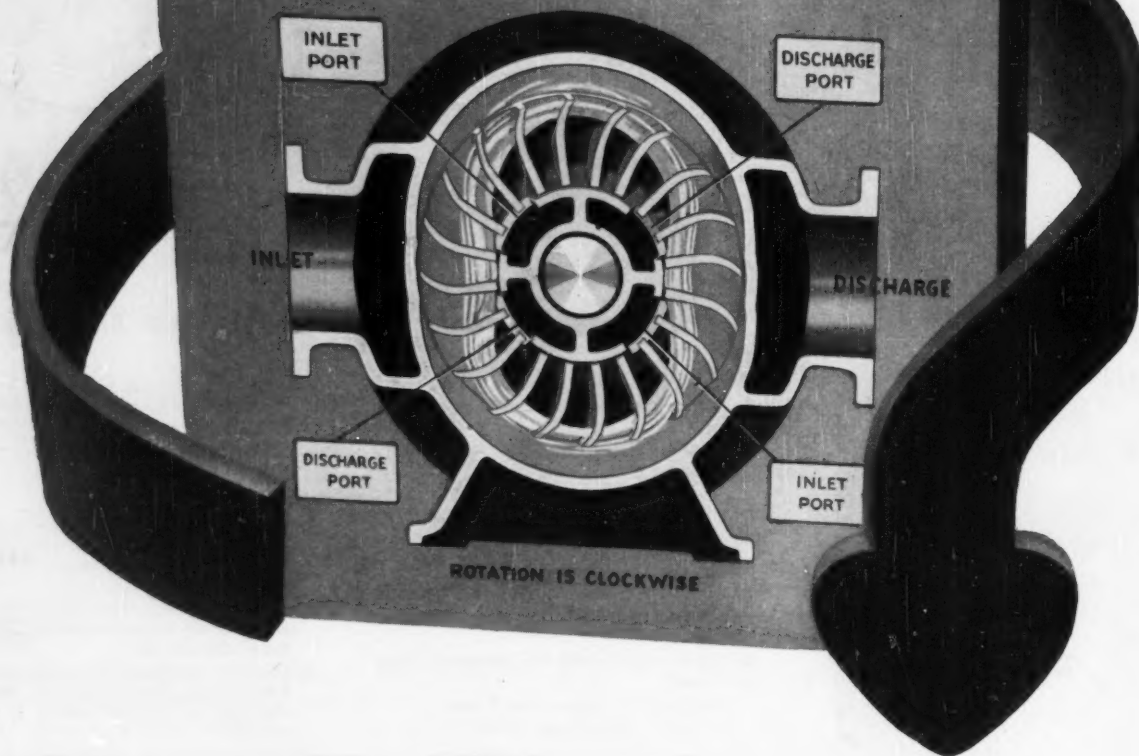
Address.....

City.....State.....

OTHERS

PLEASE ATTACH COUPON TO YOUR BUSINESS LETTERHEAD

**Nash Instrument Air Compressors
deliver only clean air, free from
oil or dust, and without filters**



Here is Why!

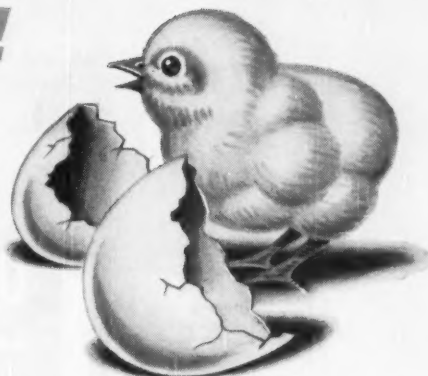
You can dispense with oil filters and dust filters when you install ©Nash® Clean Air Compressors. You can save the cost of maintaining these devices. You can greatly reduce instrument maintenance costs. For the Nash employs no internal lubrication, therefore no troublesome oil is in the delivered air. Moreover, air from a Nash is thoroughly washed and cooled as it passes thru the pump. Dust in the plant atmosphere, even fly ash, is immediately removed.

©Nash® Clean Air Compressors are simple, with only one moving element. No valves, gears, pistons, sliding vanes, or other enemies of long life and constant performance complicate a Nash. No aftercoolers are needed. You will find it profitable to investigate these pumps, now.

No oil filters.
No dust filters.
No internal lubrication to contaminate air handled.
No internal wearing parts.
No valves, pistons, or vanes.
Non-pulsating pressure.
Original performance constant over a long pump life.
Low maintenance cost.

NASH ENGINEERING COMPANY
395 WILSON, SO. NORWALK, CONN.

it's new!



VANTON'S EXTERNAL BEARING

X-B PUMP

without stuffing box, gaskets or valves

The Vanton corrosion resistant "flex-i-liner" self priming rotary type plastic pump is available in a new design that permanently protects all bearings from fumes or chemical attack.

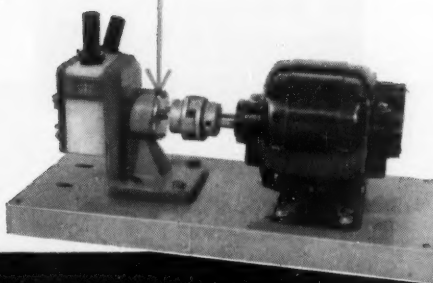
Low maintenance is assured since shaft bearings are external and the rotor assembly is stainless steel. The only wearing part is the quickly replaceable low cost flexible liner.

Capacities range from fractional to 5 gpm with 0-50 psi discharge pressures . . . Vanton XB will develop vacuum up to 26" Hg. and will handle corrosive liquids, gases, viscous fluids or abrasive slurries.

The unique design of the XB isolates the fluid from all actuating mechanisms or rotating parts. Pumping is accomplished by a rotor mounted on an eccentric shaft, creating a squeegee action on the fluid. Displacement is positive and non-agitating.

Wide selection of body block and liner materials makes Vanton XB suitable for an endless list of chemicals, pharmaceuticals and food products. Body blocks are available in: Bakelite, polyethylene, Lucite, Buna N, PVC, and stainless steel. Flexible liners are available in natural rubber, pure gum rubber, neoprene, Buna N, hycar, hypalon and silicone.

it's here



VANTON PUMP & EQUIPMENT CORP.
Division of Cooper Alloy Corporation • HILLSIDE, N. J.

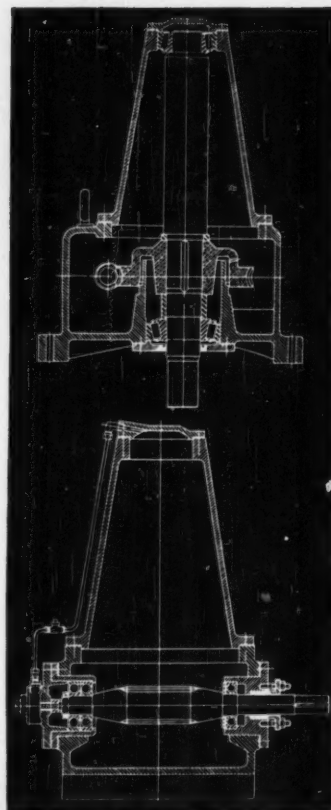


for long, unsupported
VERTICAL OUTPUT SHAFT EXTENSIONS

Use the PHILADELPHIA
**"STEEPLE" TYPE
WORM GEAR REDUCER**

The exclusive Philadelphia "Steeple" type Vertical Worm Reducer was especially developed for the numerous Process Industries for driving: Agitators, Mixers, Circulators, Pumps, Washers—and other vertical type drives which call for sturdy, reliable speed reduction.

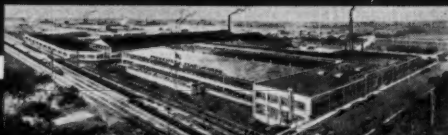
The wide bearing span insures rigidity for the extended shaft—the "dry-well" construction eliminates the necessity of a stuffing box on the vertical shaft. To insure positive lubrication of the upper bearing on the vertical shaft, an automatic reversing oil pump, together with a filter, is embodied within the unit housing. Write for full details on your Business Letterhead.



The views above illustrate cross sections through the worm and worm gear shafts. Note absence of stuffing box on vertical shaft (at top).

PHILADELPHIA GEAR WORKS, INC.

ERIE AVE. & G ST., PHILADELPHIA 34, PA.
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.
Virginia Gear & Machine Corp. • Lynchburg, Va.



Industrial Gears & Speed Reducers

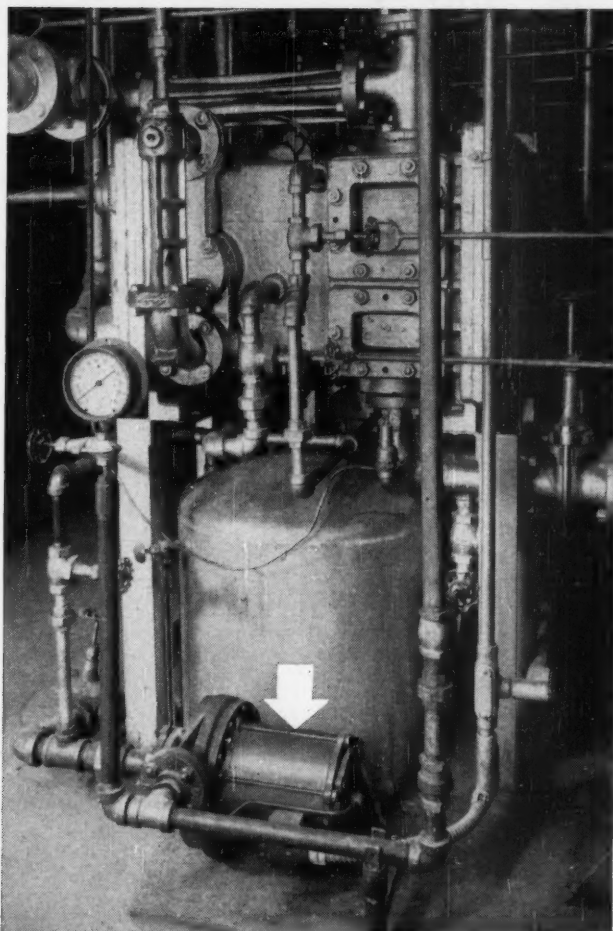
Limitorque Valve Controls

Established 1892

Chempump

**prevents
costly
leakage**

at
Bakelite Company



2 hp Chempump installed on condenser unit at Bound Brook, N. J., plant of Bakelite Company. This is a vacuum system operating at 28 inches of mercury. Pump discharges at 9 psig. Based on outstanding performance of Chempump under extreme vacuum, company is purchasing additional units.

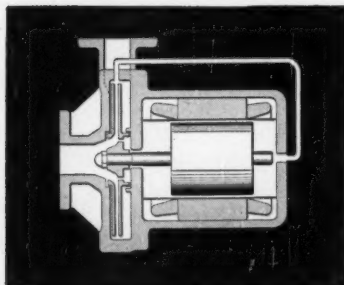
PUMPING condensate from a condenser unit under vacuum posed a critical problem at Bakelite Company. If the pump lost its prime, the condensate would fill up the tank and back up into the system, causing considerable lost time and damage. Any air leakage would destroy the vacuum and render the system inoperative.

Previous pumping equipment required frequent maintenance due to stuffing box leakage. With installation of a seal-less Chempump, however, all leakage and vacuum problems were eliminated. Virtually maintenance-free, Chempump has shown outstanding performance.

Another tough leakage problem solved by Chempump. With this seal-less combined motor-pump unit, normally hard-to-handle fluids can't leak or become contaminated. Periodic inspection to indicate necessity of simple bearing change is the only maintenance required.

Your process can benefit through Chempump, too. For details, send for new 16-page Bulletin 1010. Chempump Corp., 1300 E. Mermaid Lane, Phila. 18, Pa.

Engineering representatives in over 30 principal cities in the United States and Canada.



Chempump combines pump and motor in a single hermetic unit. Pumped fluid enters rotor chamber; no shaft sealing device required.

Approved by Underwriters' Laboratories. Available in wide choice of materials . . . from 1/4 to 7 1/2 hp. Capacities to 250 gpm. Heads to 195 feet.

Chempump can't leak!

Chempump—first in the field . . . process proved

Chempump Corp., 1300 E. Mermaid Lane, Phila. 18, Pa.

Please send me details on Chempump for:

(application)
Capacity _____ Total dynamic head _____
Name _____
Title _____
Company _____
Address _____
City _____ Zone _____ State _____



Cut Costs Three Ways with **Rockwell-Nordstrom** **Chemical Valves**

- 1 LOWER MAINTENANCE:** Rockwell-Nordstrom valve lubrication is *preventive* maintenance that eliminates metal-to-metal friction and stops most valve maintenance problems before they start. Cost records in hundreds of chemical plants prove that lubrication is far less expensive than even routine maintenance (reseating, packing, etc.) on ordinary valves.
- 2 LESS DOWN TIME:** When you use Rockwell-Nordstrom valves, lubrication and rugged design assure dependable, trouble-free operation. Lubrication also makes the quarter-turn operation smooth and easy for perfect flow control. Stuck, galled or jammed valves are eliminated because the plug can be hydraulically jacked for instant operation.
- 3 LONGER LIFE:** The thin, tough film of lubricant *continuously* protects the working surfaces. Also, the seats (the parts that wear out fastest on ordinary valves) are *never* exposed to corrosive-erosive line materials. And Rockwell-Nordstrom valves are the simplest of all valves—basically a plug and a body. There are fewer working parts to wear out or break.

Rockwell-Nordstrom valves, *the original* lubricated plug valves, are available in a complete range of sizes and pressure temperature ratings in semi-steel, steel, stainless steel and other corrosion resisting alloys. Whatever your needs, there is a size and type that will do the job with more trouble-free dependability and at lower cost than any other valve you've ever used. Write for complete details today: Rockwell Manufacturing Company, Pittsburgh 8, Pa. Canadian Valve Licensee: Peacock Brothers Limited.

ROCKWELL-Nordstrom VALVES

LUBRICANT SEALED FOR POSITIVE SHUT-OFF

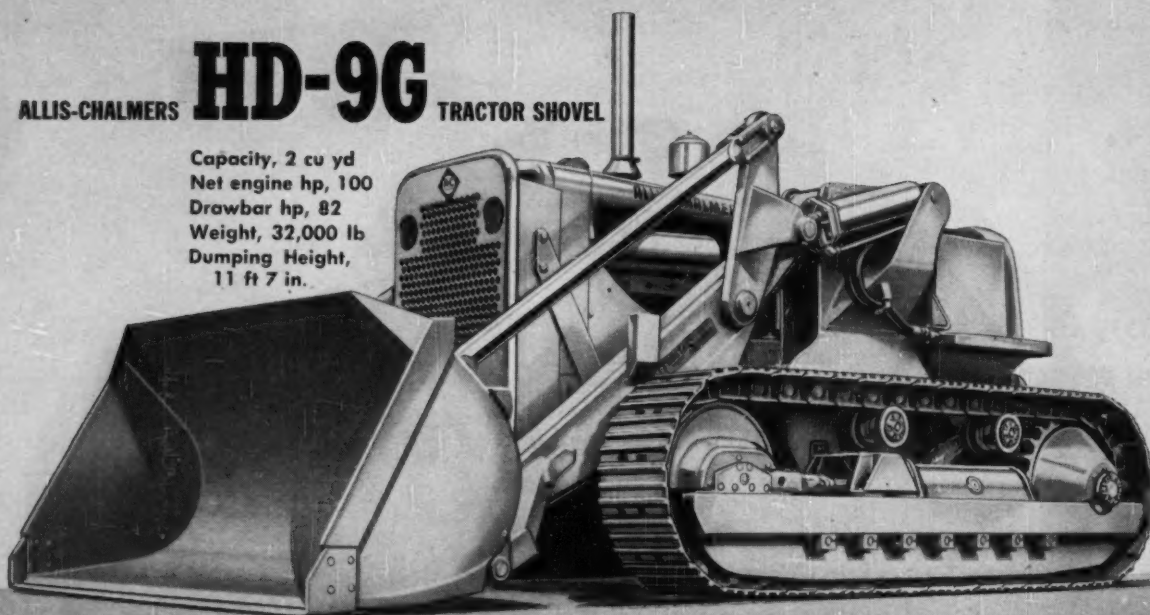


ALLIS-CHALMERS

HD-9G

TRACTOR SHOVEL

Capacity, 2 cu yd
Net engine hp, 100
Drawbar hp, 82
Weight, 32,000 lb
Dumping Height,
11 ft 7 in.

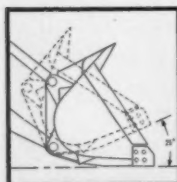


POPULAR 2-YD HD-9G TRACTOR SHOVEL NOW OFFERS

Higher Work Capacity

Design refinements in the Allis-Chalmers HD-9G now make it even more productive than ever. First, the net engine output has been increased to 100 hp, with 23,000 lb of push for extra crowding and digging ability, fast work cycles.

Streamlined bucket design now helps roll in large loads with less tractor effort. The back of the bucket has been brought forward and the sides extended to cut spillage, put more pay load where it's wanted. Cleaner dumping with the new bucket saves the operator time and effort shaking out loads.



Tip-Back bucket can be carried lower to the ground for greater stability . . . can load bulky objects easier.

New-type ceramic master clutch lining reduces lever pull, makes it easier for the operator to do more. The new HD-9G helps the operator do more in other ways, too — giving him full vision, fast and easy control, cleaner platform and more comfortable seat from which to work, and more working time with truck wheels, support rollers and idlers that need greasing only once every 1,000 hours.

A new addition to the wide variety of attachments available for the HD-9G Tractor Shovel is the Tip-Back bucket which allows the operator to roll the bucket back approximately 25° at ground level. Ideal for handling greater capacities of loose stockpiled materials, the

Lower Operating Cost

Design improvements also add longer life to the HD-9G under all work conditions. Heavy box-section booms are 50 percent stronger, assuring proper alignment even working in the toughest materials. The low design of the new HD-9G combination stabilizer and cowl not only offers easy accessibility for maintenance and service, but contributes to maximum operator vision. New ceramic master clutch lining operates longer between adjustments, increases clutch life.

Hydraulic system provides new maintenance simplicity, safety of operation, as well as improved visibility. With new-style tank, there are few external fittings, greatly reducing possibility of outside leaks. Magnetic filters and suction-line screens protect the entire system from damaging grit. New, improved hydraulic pump is designed for long life as well as fast and accurate bucket action.

Heavy-duty truck wheels and idlers are available for particularly tough working conditions. One-piece, full-length main frame permits unit construction so that major assemblies can be removed without disturbing adjacent units, putting tractor back on the job in hours rather than days.



See your Allis-Chalmers dealer for further information on what the HD-9G can do for you — or a demonstration right on your job.

ALLIS-CHALMERS

TRACTOR DIVISION — MILWAUKEE 1, U. S. A.

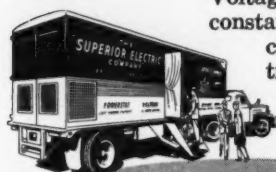
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***Varying Voltage Troubles** can occur in your plant every time voltage varies — and that can be happening many times a day!

V.V.T. can cause process upsets and recycling . . . make control panels "lose control" . . . instruments become inaccurate . . . tube failures in electronic equipment . . . burned out motors. A single section can be "dogged" by V.V.T. — or your entire process line.

The cure is simple and effective: a **STABILINE** Automatic Voltage Regulator that will hold voltage constant regardless of line voltage or load changes. Ask your local electric distributor or write for full information.



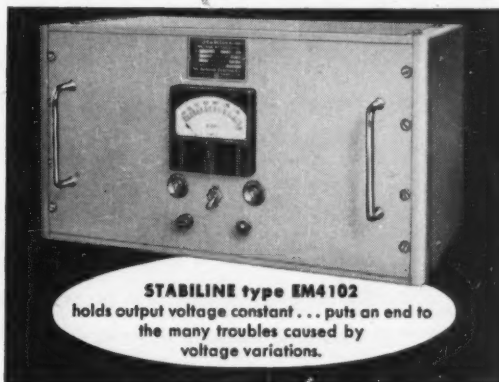
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holds output voltage constant . . . puts an end to
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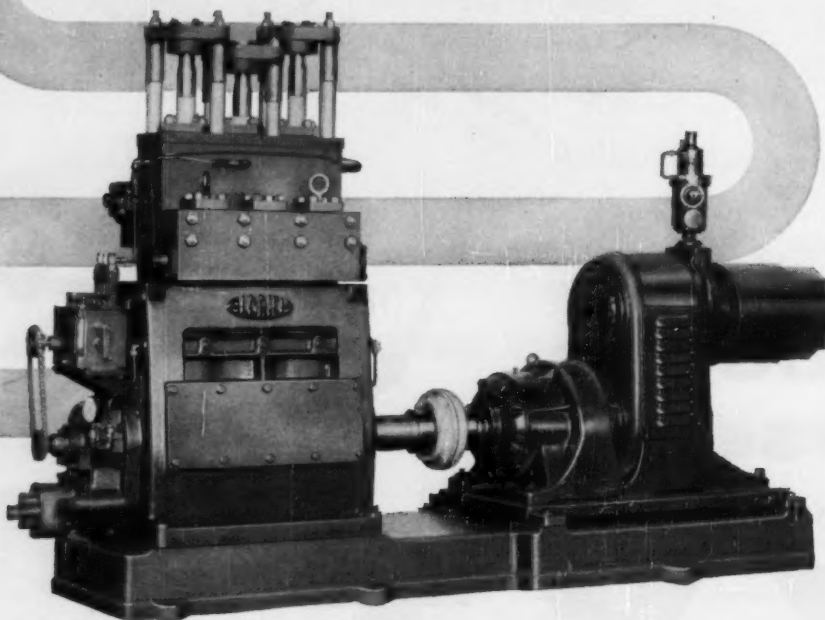
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Here's an Aldrich Triplex specifically made to pump very highly abrasive slurry that would make short work of most pumps. A typical special Aldrich design, it features solid porcelain plungers—Kennametal ball valves and seats—an oversized oil pump for slow operation. Variable drive is provided by a U. S. Varidrive motor operated by Varitrol automatic control.

Aldrich Pumps are ideal for applications involving corrosion, high viscosity, high pressure, or abrasive materials . . . and the complete range of sizes insures a proper Aldrich pump for every need. Ask for recommendations to meet *your* chemical pumping needs.

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There's one right way to buy pressure tubes— it's tube life per dollar: *Ask the experts!*

This month's report is on:

DM STEEL

Has unusually high creep strength for a pearlitic steel, good stability up to 1200°F., fairly good corrosion and oxidation resistance. Has 2 to 3 times the life of carbon steel where corrosion is not severe. Recommended for cracking furnace tubes, hot oil lines, superheater tubes, high temperature steam piping and forgings for accessory parts.

ONE OF 24 TIMKEN HIGH TEMPERATURE STEELS

Carbon	Sicromo 2	Sicromo 5S	18-8 Ti
Carbon-Mo.	Sicromo 2½	Sicromo 5MS	16-13-3
DM-2	2½% Cr.-1% Mo.	Sicromo 7	25-20*
Silmo	Sicromo 3	Sicromo 9M	25-12*
DM	4-6% Cr.-Mo.	18-8 Stainless	35-15**
2% Cr.-Mo.	4-6% Cr.-Mo.-Ti.	18-8 Cb	16-25-6**

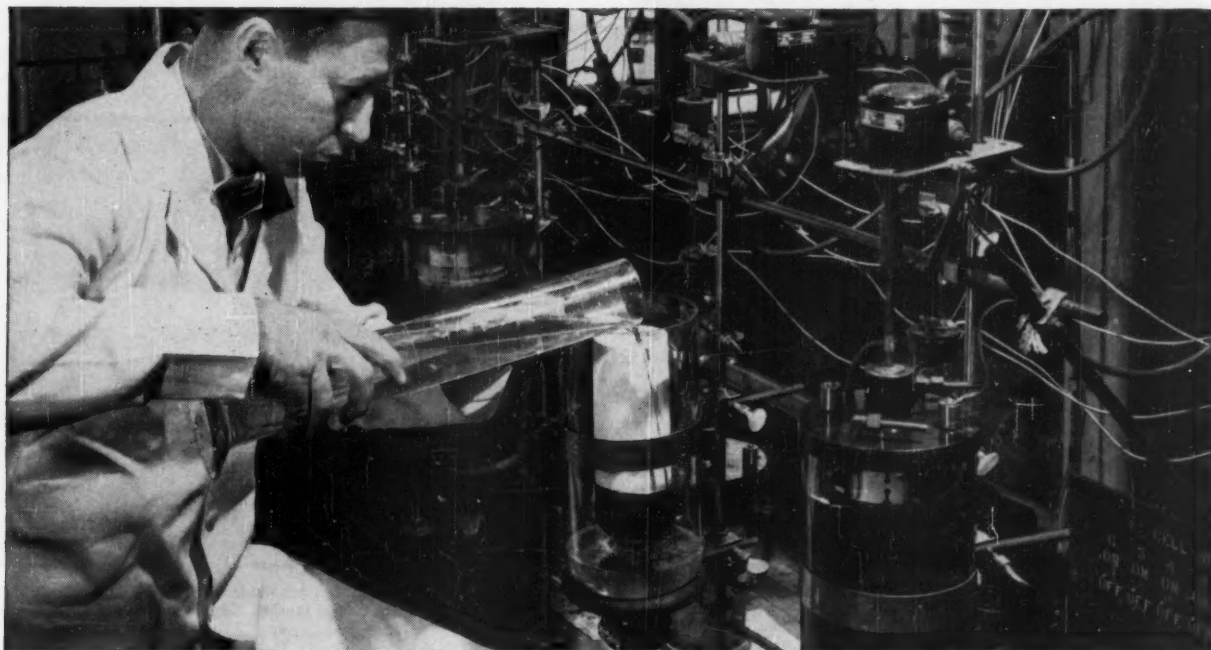
*Available as seamless tubing on an experimental basis only.
**Not available as seamless tubing.

YOU'RE fortunate in having the Timken Company's large choice of high temperature tube steels that will solve your heat, pressure, corrosion and oxidation problems. You're even more fortunate when you choose the *one* analysis that will give you maximum tube life per dollar—the only true index to actual tube steel cost.

To find it, *ask the experts!*

These experts are the metallurgists of The Timken Roller Bearing Company. They'll put their more than 20 years of steel research and experience—with emphasis on high temperature steels—at your disposal. Help you select from 24 different analyses the one tube steel that will give you the best life/cost ratio. Regardless of which analysis you select, you'll be assured of uniform quality. Because the Timken Company rigidly controls quality from melt shop through final inspection.

Let the Timken Company's metallurgists help solve your tube problems. *Ask the experts!* The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".



Electrolytic equipment used in Timken Company laboratories to extract non-metallic inclusions from steels in research on steel cleanliness

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

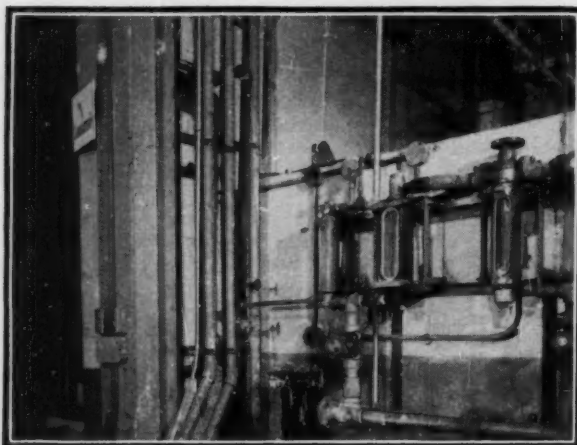


SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

CHEMICAL ENGINEERING—May 1955



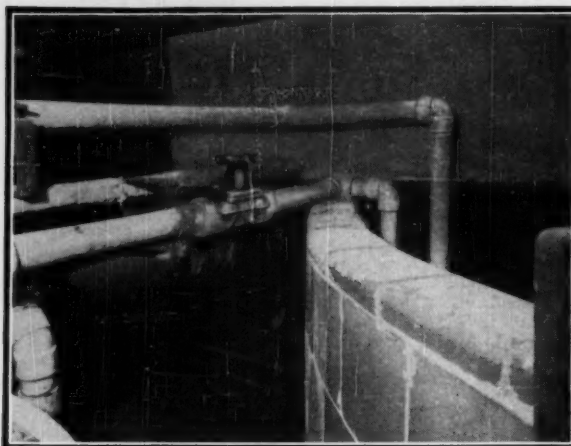
Section of U. S. Uscolite plastic piping forming a manifold carrying highly corrosive alum from storage tanks. Here the alum line is broken up to carry it to several paper machines. Uscolite shows no sign of corrosion, after 2 years' service.



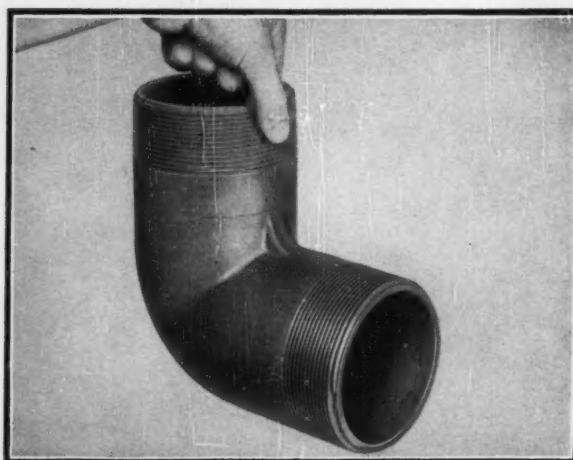
Uscolite piping and flanges on the lower bleach line. Two interchangeable pumps draw the bleach liquor from the bottom of the storage tank to the paper machines. The bleach liquor corrodes the insides of metal pipe—and the fumes, the outside. Uscolite pipe shows no signs of corrosion after 2 years of wear.

Uscolite® plastic piping, fittings, flanges, deflectors, valves and fume ducts will handle any chemical used in paper mills, including alum, bleaches, brines, and chlorine. A product of United States Rubber Company, Uscolite is extremely light in weight, yet has very high impact strength. It is threaded and assembled with ordinary piping tools—*without* special preparation. Immediate delivery of standard sizes of pipe and fittings. The Uscolite Hills-McCanna

Paper mill licks corrosion problems with U. S. Uscolite plastic



Uscolite piping taking bleach liquor from the storage tanks—via the upper bleach liquor line. Here the Uscolite pipe replaced metal pipe and rubber-lined pipe. Bleach liquor must be fed at an even rate. Unlike metal pipe, Uscolite piping does not build up internal deposits, and thus permits steady flow and control at all times.



Uscolite pipe and fittings are made in broadest and largest line of stock sizes on the market. Sizes run from 1/2" to 6".

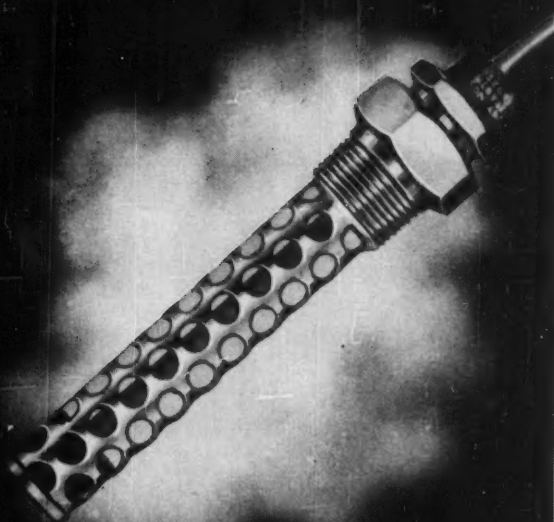
valve is also available. Call any of the 27 "U. S." District Sales Offices or write to address below.



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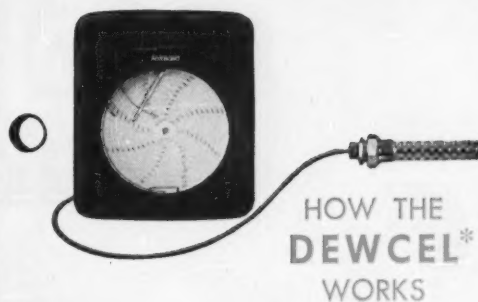
directly . . . accurately . . . continuously

Now you can measure or control the humidity of air or process gases with simplicity and accuracy never before obtainable!

An entirely new-type humidity-sensitive element, the exclusive Foxboro Dewcel*, opens many new possibilities for product improvement in industry. Coupled with a Foxboro Recorder or Controller, the Dewcel offers these outstanding advantages:

1. Direct recording in dew point temperature, at existing pressure.
2. Wide working range — even operates at sub-zero temperatures.
3. Neither adds nor removes water from atmosphere.
4. No water box or circulation of air required.
5. Simplicity that eliminates maintenance.
6. High sustained accuracy.
7. Initial and operating economy.

Investigate Foxboro Dew Point Control for your process. In successful use in nuclear fission, pharmaceutical, food and chemical plants, distilleries, photo film production, drying and storage operations. Write for Bulletin 407. The Foxboro Company, 365 Neponset Ave., Foxboro, Mass., U.S.A.



The Dewcel element is a thermometer bulb (liquid-filled or electric-resistance type) jacketed with lithium-chloride-impregnated woven glass tape. Over this are wound two spaced gold or silver wires connected to an AC source. The lithium chloride absorbs moisture, allowing current to flow, generating heat, and raising the temperature. Equilibrium temperature is reached when vapor-pressure of the moist salt exactly balances that of the surrounding air or gas. The System translates this temperature into direct readings of dew point.

Thus, Foxboro Dew Point Instruments give direct readings or control of dew point from -50°F. to 142°F. at working temperatures from -40°F. to 220°F. Readings easily converted to absolute or relative humidity.

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➔ STICKS to hot or cold surfaces ➔



BECAUSE IT STICKS, it saves time! Eagle-Picher Super "66" *really sticks*, makes difficult jobs easy, usually requires no reinforcing on applications up to 1½ inches thick. It applies quickly to any equipment, cold or heated up to 1800 F.

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PREVENTS RUST, TOO! Super "66" contains a special rust inhibitive that actually prevents corrosion.

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Prove to yourself how easy it is to apply Super "66" wherever insulation is needed!

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(Conforms to Commercial Standard CS117)

Corrosioneering News

Quick facts about the services and equipment Pfaudler offers to help you reduce corrosion and processing cost.



Published by The Pfaudler Co., Rochester, N.Y.

CORROSION GUARANTEE ANNOUNCED!

Now—a year's corrosion guarantee on Pfaudler vessels
used in processes containing hydrochloric acid!

If your product has hydrochloric acid as its principal corrosive agent, and you operate in the range represented by the darkest area on our chart, you can now have processing equipment which carries a full year's guarantee against corrosion!

If chemical attack should render your Pfaudler glassed steel equipment unusable within its first year of use under the operating conditions specified in the guarantee, Pfaudler will replace or repair it without charge by on-the-spot methods or on an F.O.B. factory basis.

You receive this guarantee on all glassed steel equipment supplied with Pfaudler acid-alkali-resistant glass, when it is expressly purchased for processing hydrochloric acid in the

specified range of conditions. Such equipment includes reaction kettles, stills, receivers, condensers, heat exchangers and storage tanks.

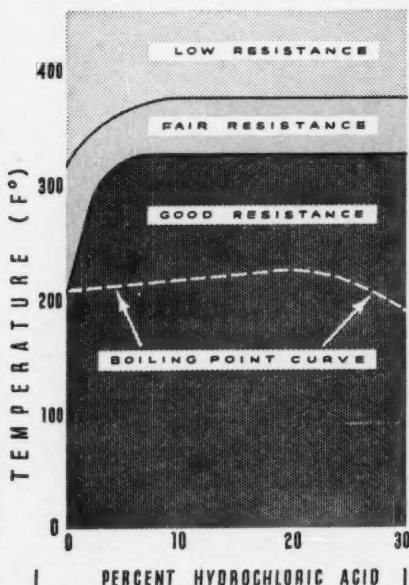
The guarantee, in written form, is delivered with the equipment, and states clearly the operating conditions under which it applies.

You'll find three important advantages in this unique guarantee:

1. It minimizes the possibility of major shutdowns caused by corrosion of equipment.
2. It frees you from large maintenance or replacement costs.
3. It assures you that the glassed steel equipment you buy is *matched to your process*, selected for its special resistance with reference to *your product*.

Perhaps you have a problem right now, for which this guaranteed corrosion-resistant equipment offers a solution. Call in your Pfaudler representative and discuss your needs with him.

Or write for Bulletin 205, "Glassed Steel—Its Resistance to 92 Corrosives, Forms Available and Applications."



Corrosion resistance of Pfaudler acid-alkali-resistant glass by hydrochloric acid.

For concentrations and temperatures in darkest area, glassed steel equipment is guaranteed against corrosion. In the "fair resistance" and "low resistance" areas, Pfaudler glassed steel may often be the most resistant material of construction available to you at reasonable cost. To make this decision, Pfaudler should be consulted, and tests may be run in either your plant or at the Pfaudler laboratory.



Glassed Steel Long Used For Tough Corrosive Problems

Field data which form the basis for Pfaudler's new guarantee against corrosion has been compiled from thousands of installations, such as these glassed steel reactors in use at Distillation Products Industries. Pfaudler glassed steel units have solved problems of corrosion since 1884, are continually being improved to meet new demands of higher temperatures and pressures.

Three reasons why you can now get this unusual anti-corrosion guarantee

Like all Pfaudler chemical processing equipment, glassed steel *always* has been guaranteed from the standpoint of workmanship.

But why is it that you can now get a *corrosion* guarantee—a written agreement that your equipment will hold up under corrosive attack for at least a year?

Reason No. 1 is the glass itself. Pfaudler's new acid-alkali-resistant glass, now standard on chemical processing equipment, is a special type of glass which not only resists most acids, but also can be used for alkalis up to pH 12 and 212° F.

Reason No. 2 is the sensible approach to a specific problem by corrosion engineers. We know what glassed steel can do, and what it can't. Field and laboratory data provide the background for deciding between glassed steel and other materials.

Reason No. 3 is our general policy on the equipment we sell. During its fabrication, we inspect it carefully at several check points. No vessel for severe chemical service leaves the factory until every square inch inside has been given a spark test to make sure the glass completely covers the steel to a certain minimum thickness.

12-MONTH GUARANTEE against corrosion is now offered with Pfaudler glassed steel equipment for processing a number of specific chemicals; hydrochloric acid, dis-

cussed in this article, is one of them. Other products which are covered under this unique guarantee will be discussed in future issues of *Corrosioneering News*. Watch for them.

HELPFUL "project engineering service" can save time and money for you on your next new chemical process

When you get the green light on a new process, or when you decide to revamp an old one, you have two courses of action:

1. The costly way is to dump the project into the lap of your own already overworked staff. Let them handle all the angles – test materials of construction, get prices and specifications from platoons of suppliers, compare design features, work out the special wrinkles, such as heat exchange and agitation peculiarities. The results might be acceptable – but you pay *plenty* in terms of extra man-hours of work and disruption of your normal operations.

2. Or you can get help – take the load off your own staff, and take advantage of the experience offered by a fully informed team with over 70 years of chemical equipment manufacturing upon which to draw. This is the project engineering team at Pfaudler.

or with your consultant, the Pfaudler team helps them select equipment for the process, advising them on possible savings such as "flexible standard" designs wherever possible. Pfaudler then undertakes actual fabrication or procurement of this equipment.

This "meeting of minds" early in the project assures you of the proper application, operation and maintenance of Pfaudler equipment.

2. *Selection of Materials.* You get im-

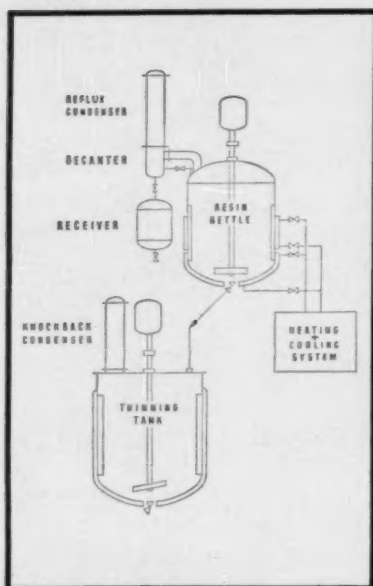
partial selection of construction materials, because these engineers are entirely free to use glassed steel, stainless steel and all the practical alloys.

3. *Corrosioneering.* Specializing in the study of new ways to combat corrosion, The Pfaudler Co. gives you the advantages of 71 years of building corrosion-resistant equipment.

4. *Equipment Design.* You get the money-saving advantages of such standard equipment as Pfaudler reaction kettles, heat exchangers, columns, tanks and other components.

5. *Fabrication and Delivery.* You can depend on a sensible schedule of deliveries, since everything, including auxiliary equipment, is coordinated by Pfaudler.

A short pamphlet about Pfaudler services, Bulletin 511 tells exactly what you get, and what we must know to tackle your problem. It may save you thousands of dollars. Write for it today.



This resin synthesizing system was assembled to meet customer's specifications by Pfaudler project engineering group and supplied to user as a "packaged" system.

One example of their operation is the resin synthesizing plant shown in the diagram above. This relatively simple plant is just one of many types that have been completely engineered, fabricated and assembled by the Pfaudler project engineering group with chemical process and capacity data supplied by the customer.

Pfaudler project engineers can help you select the basic equipment units, carrying through the five steps listed below:

1. *Project Engineering.* Working closely with your development group,

"Vive la resistance!" (corrosion resistance, that is)



Here you see the Pfaudler exhibit at the "Salon de Chimie" held in Paris, France, recently.

Corrosion is as much a problem in Cologne, Cape Town and Kyoto as it is in Kansas City—therefore, Pfaudler corrosion-resistant processing equipment is used around the globe.

You can buy this equipment in pounds sterling, Deutsch-marks, yen, and dollars. Manufacturing plants are located in Germany, Scotland and

Japan, as well as both Elyria, O., and Rochester, N. Y., U.S.A.

Pfaudler equipment was or will be seen at these overseas trade shows: Italy—International Fair, Milan, April 1954

France—Salon de Chimie, Paris, December 1954

Japan—International Trade Fair, Tokyo, May 5-18, 1955

Germany—Achema, Frankfurt, May 14-22, 1955

Heat Exchanger Solves Cleaning, Gasket Problems

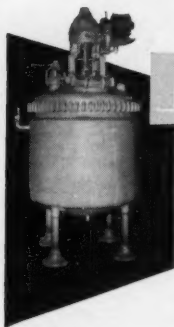
Pfaudler's Type FTS (fixed tube sheet) heat exchanger has won friends throughout the chemical processing industries. A money-saver, it features replaceable straight tubes, is easily cleanable on the inside and eliminates internal gasket leakage problems.

The shell is permanently welded to the tube sheets, doing away with gaskets or packed joints on shell side. There

are no internal gaskets—no possibility of leakage or intermixture of fluids.

Original cost of Type FTS heat exchanger is low, because of its simple construction and standard design. Up-keep is low, because tubes are easy to clean, and you eliminate the problem of replacing costly internal gaskets.

For complete data on this cost-cutting "workhorse," write for Bulletin 837.



TECHNICAL TALKS

Some important facts you

should know about STRESS-CORROSION

by DAVID K. PRIEST, Ph.D.

The author has devoted much time to a study of stress-corrosion, and we reproduce here part of a paper he has done on the subject. If you have further questions, perhaps our continuing study, and extensive files on the subject, will help. Please write.

Dr. Priest is head of the corrosion research section, Pfaunder Research Laboratory. He joined the laboratory staff in 1953. At the Corrosion Research Laboratory of Ohio State University, where he received a Ph.D. degree in metallurgy, the author specialized in the study of stress-corrosion. The investigations made there were the basis for both a doctoral dissertation, and a half-hour motion picture which shows, under magnification, the actual progress of stress-corrosion in a magnesium-base alloy.



Stress-corrosion is defined as the acceleration of the rate of corrosion by stress. In this type of attack, stress and corrosion, acting together, produce failure by cracking much more quickly than corrosion acting alone and at stresses which would not produce failure at all in the absence of corrosion. The stress-corrosion attack usually takes the form of a rapid penetration or cracking along grain boundaries although many systems exhibit transgranular stress-corrosion cracking. Stress-corrosion has been observed in almost all metals or their alloys but each metal or alloy often requires a certain characteristic corrosion environment.

Stress-corrosion is usually confined to corrosion systems which are intermediate between an active and a passive state where severe local attack may develop. Intergranular stress-corrosion usually occurs under conditions favorable to metal dissolution at grain boundaries but the exact causes of transcrystalline failure are not well understood.

It has been found that only tensile stresses promote stress-corrosion.

The Origin of Stress in Metals

Macroscopic residual stress or body stress may originate from inhomogeneous cold working, inhomogeneous plastic deformation due to non-uniform heating or cooling (such as may be produced by quenching), and structural or chemical non-uniformities which result from volume changes caused by transformations such as in nitriding.

Microscopic or textural stress may originate in the same manner as the macroscopic stress but other sources of textural stress are recognized. For example, grain boundaries are regions of stress brought about by the misalignment of the crystal structures of neighboring grains.

In the grain boundary region, the atoms of one grain try to align themselves with the same orientation as an adjacent grain. Elastic stresses are produced in this region of atomic disorder. Slip and twinning also produce textural

stress. In a stressed polycrystalline metal, grains of different orientation will be stressed to different degrees of stress because of the dependence of slip on the grain orientation.

Internal stress is additive to load stress and if the internal stress is correctly orientated, only a small additional amount of load stress could cause stress-corrosion.

When a notch of a critical size appears on a stressed metal surface (whether caused by corrosive attack or not) the stress distribution in the vicinity of the notch is changed. The longitudinal stress at the notch base rises to an extremely high value. The ratio of this high stress value to the nominal stress is called the stress concentration factor. The sharper and deeper the notch becomes, the greater is the stress concentrating effect. This "notch effect" is of great importance in the phenomena of stress-corrosion because a stress-corrosion crack causes stress concentration and tends to propagate itself.

A Brief Review of Some Stress-Corrosion Systems

Some alloys of almost all metals are subject to stress-corrosion. In the following section some of the more interesting examples of stress-corrosion will be reviewed.

1. Copper Alloys

One of the earliest recognized examples of stress-corrosion is the season cracking of brass cartridge cases. The cracking is intergranular and occurs in air after long periods of exposure. Stress-corrosion testing of copper-zinc alloys has established that atmospheres containing even traces of ammonia can cause failure. Ammonia solutions, amines, and water or water vapor have also been reported as stress-corrosion environments for copper-base alloys.

2. Aluminum Alloys

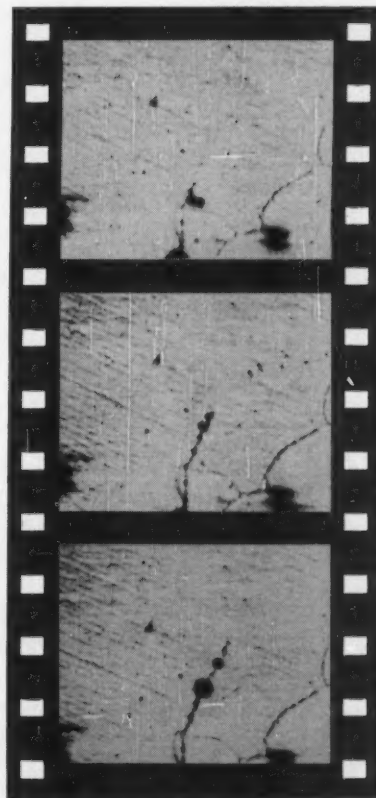
In alloys of aluminum, evidence has been produced that stress-corrosion is primarily an electrochemical process. In

certain aluminum alloys the precipitation of CuAl_2 at the grain boundaries produces an anodic zone depleted of copper. Selective attack at these anodic areas results in intergranular stress-corrosion cracking.

3. Magnesium Alloys

Stress-corrosion does not occur in pure magnesium. As aluminum additions to magnesium alloys are made, however, the susceptibility to this type of failure increases up to 6.5 percent aluminum when testing is carried out in 3 percent sodium chloride-3 percent potassium chromate solution. Transgranular stress-corrosion is usually reported for magnesium alloys. The stress-corrosion of magnesium alloys can occur in several other environments. Exposure to the atmosphere, distilled water, tap water or sodium chloride solutions can cause failure; the first and last of these being the most important commercially. Most of the investigators of this subject have used a 3 percent sodium chloride solution inhibited by 3 percent potassium chromate.

This writer has recently proposed a
(Cont'd on next page)



These enlargements, 2 seconds apart, show stress-corrosion cracking of magnesium-base alloy in a picric acid etch. Taken from movie, "Stress-Corrosion."

Pictures courtesy Transactions, Am. Soc. for Metals

Corrosioneering News

mechanism of transgranular stress-corrosion in a magnesium alloy. He has suggested in this work that this mechanism is essentially electrochemical in nature. This work has shown that transgranular stress-corrosion takes place predominantly along the basal plane of the hexagonal close packed structure of this alloy. Other studies have shown that a segregation of the cathodic phase FeAl exists in this alloy along a crystallographic plane. It is reasonable to conclude, then, that preferential attack occurs along the basal plane due to the potential difference between the segregated FeAl and the solid solution.

4. Mild Steel

It has been known for many years that riveted equipment of mild steel is liable to failure by stress-corrosion when in contact with caustic solutions. The

cracking is usually described as intergranular but transgranular failure of both mild steel and low alloy steel in a vessel containing 50 percent sodium hydroxide at 250° F and under 400 psi has been reported. The cause of failure is variously described as due to hydrogen embrittlement, a continuous film of distorted ferrite in the region of the grain boundaries, or the stress-induced precipitation of iron nitride.

5. Austenitic Stainless Steel

The stress-corrosion cracking of austenitic stainless steel may be divided into two different forms. The first of these is an intergranular cracking brought about by exposure in a suitable environment of a sample which has been sensitized to intergranular attack by heating in the range of 540 to 760° C. In this temperature range, chromium carbide is precip-

itated at the grain boundaries, which depletes adjacent areas of chromium leaving them susceptible to intense local attack. The presence of stress in such a situation acts to localize further and accelerate the attack. The second form of stress-corrosion is transgranular cracking in hot chloride and caustic solutions. The latter is perhaps the more prevalent type of failure.

6. Nickel and Nickel Alloys

Cracking of highly stressed nickel has been observed in fused sodium hydroxide and fused potassium hydroxide. Strong solutions of sodium hydroxide and potassium hydroxide (30% and above) at temperatures of 310° C and above have also been observed to cause cracking. Some cases of failure of Monel metal are recorded in hydrofluorosilicic acid, chromic acid and sulphonated oil.

Glassed valves combine work-saving features with corrosion resistance and strength

For your tank and pipeline assemblies, here are glassed valves that give you both the corrosion resistance of glass, plus the structural strength of cast iron.

These valves are offered in several types, as outlet valves, pop safety valves, diffusers, and line valves.

They all give maximum protection against corrosion, because they are all lined with Pfaudler acid-alkali-resistant glass.

Standard design features:

Standard porcelain seats and heads are uniform ring sections and are, therefore, so free of unequal temperature expansion that they are being used for temperatures up to 400° F and pressures up to 150 psi.

Stainless steel and Hastelloy can be used for seats, heads, and stems on glass-lined valves.

The mismating angles of head (30°) and seat (25°) result in a line contact, thus assuring the minimum amount of surface to lap.

Relapping and reseating of the head is done without special tools by simply turning a small handwheel. This same feature serves to prevent damage to the seat, because turning this wiper wheel

while the valve is being closed will clear the seat of any potentially harmful particles. The seat is a separate unit attached to the body lining, a design feature which offers two advantages: (1) The seat bears no pipeline strains, and (2) it permits replacement of the seat, if necessary.

Pfaudler valves can be attached to 125-lb. cast-iron or 150-lb. steel flanged fittings, since the valve flanges have the same bolt circle and number of bolts.

Outlet valves:

Flush type: Makes use of tank pressure as well as mechanical pressure to hold the valve tightly closed. Head is forced against seat. In opening, the head moves up, breaking through the layer of residue often present in bottom of tank.

Globe type: Reversing the holding principle of the flush valve, the globe valve is suitable for flow regulation. Only mechanical pressure, holding the head against tank pressure, keeps the seat tight.

Pop safety valve:

This is a spring-operated valve which has a blow-down effect. The valve remains tight until practically at relief

pressure, and when it pops, it drops the pressure down about 10% before closing.

Diffuser valves:

To obtain the fine bubble necessary for efficient gas incorporation, the gas should be introduced into the reactor as close as possible to the point of maximum product agitation. The Pfaudler diffuser valve accomplishes this by having an extended seat and a special head, and by being installed in a special



Flush Valve Pop Safety Valve Line Valve

nozzle directly below the outer edge of the agitator blade circle.

Valves for line assembly:

Acid-resistant pipeline valves are simply tank valves with a body connector added to adapt them for line use. The body connector can be assembled for either straight-line or right-angle mounting, and the mounting can be changed from one direction to the other by the user, since the connector is bolted on.

Pfaudler

Corrosioneering News

Published by The Pfaudler Co., Rochester, N. Y.

Designers and fabricators of glassed steel and alloy equipment for the chemical processing industry. Factories in: Rochester, N. Y.; Elyria, Ohio; Leven, Fife, Scotland; Schwetzingen-Baden, Germany; Kobe, Japan.

Sales offices in all principal cities of world.

The Pfaudler Co., Dept. CE-5, Rochester 3, N. Y.

Please send me:

- ☐ Bulletin 205—"Glassed Steel—Its Resistance to 92 Corrosives."
- ☐ Bulletin 511—"Pfaudler Services."
- ☐ Bulletin 837—"Heat Exchangers and Condensers."
- ☐ Bulletin 886—"Pfaudler Pipe, Valves, Fittings."

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Title _____

Company _____

Address _____

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How to get the right fabrics for clear-flowing filtrates

Maybe filtrate clarity is your problem . . . or the efficient recovery of valuable solids. There's no need to remind you of the hundred-and-one things that can go wrong in a filtration operation. Nor—most of the time—of the reasons why. But isn't it true that many of these production failures could very well be solved by

- 1) the right type of
- 2) well-made filter medium
- 3) correctly installed?

With our century-plus experience in supplying fabrics for industry, this is where we enter the picture.

Whether it's cotton or synthetic . . . for whatever type of fabric-using equipment . . . in any segment of the chemical or processing industries . . . there's a Wellington Sears fabric in use—or one we can develop—that will solve your problem.

In addition, we offer the services of leading filter cloth specialists throughout the country who distribute our filter fabrics. We will be glad to supply the names of distributors, together with a free copy of "Filter Fabric Facts"—illustrated booklet on filter fabric development and application. Write: Wellington Sears Co., Dept. A-1

Wellington Sears

A Subsidiary of West Point Manufacturing Company

FIRST In Fabrics For Industry

Wellington Sears Company,
65 Worth Street, New York 13, N.Y.

Offices in: Atlanta • Boston • Chicago • Dallas • Detroit • Los Angeles • Philadelphia • San Francisco • St. Louis

HERE'S REAL MATERIAL HANDLING NEWS

New STEARNS 2-coil magnetic pulley removes more tramp iron than larger units on many conveyor operations—yours may be one

Stearns now offers a powerful new electro-magnetic pulley that provides exceptional tramp iron removal *throughout the entire load mass*. Two-coil design produces a magnetic field that is deepest at the center of the conveyor belt where load is heaviest. The area of magnetic attraction is the same general shape as the load on a conveyor operating under standard conveyor practices.

Pulley costs less

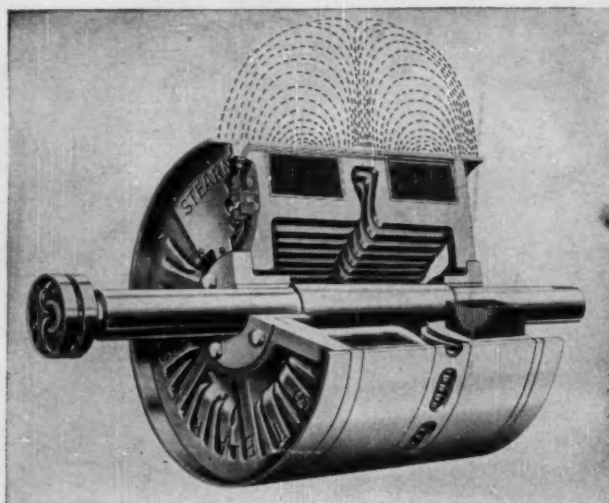
Because of the nature of the magnetic field, smaller pulleys costing less, can now be used on jobs where larger units were formerly needed. An examination of data on a number of proposed installations showed that, in the majority of the cases, the recommended new 2-coil pulley is of smaller diameter than a 3-coil pulley handling the same job.

Get all the facts on this new magnetic pulley. Find out how it simplifies pulley selection. Write for bulletin 303-C.

SIMPLIFIED PULLEY SELECTION METHOD*

Because this pulley fits right into recommended conveyor standards for speed of belt travel and depth of load for various types of materials, it is far simpler to select the right pulley than ever before. Stearns provides new selection tables in Bulletin 303-C that now make it possible for you to select the right size unit for your job even before you consult our sales engineers.

*Copyrighted 1954 Stearns Magnetic, Inc.



Cutaway showing 2-coil construction. This design provides a deeper magnet field at the center of the pulley — a pattern which conforms to normal load conditions.



Diagram showing magnetic field for 2-coil, 36-in. dia., 42-in. wide pulley. Note how magnetic field blankets entire load.

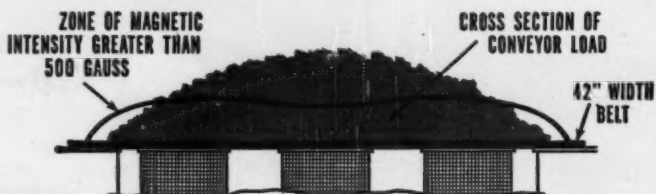


Diagram of same size 3-coil pulley. Note how center of load extends above magnetic field. Conveyor would require a larger pulley operating at slower speed in order to do an effective tramp iron removal job.

1106

MAGNETIC EQUIPMENT FOR ALL INDUSTRY

STEARNS  **MAGNETS**

STEARNS MAGNETIC, INC., 629 S. 28th St., Milwaukee 46, Wis.

If your heat transfer system
goes up to 600°F....



SOCONY-VACUUM

*process
products*



SOCONY-VACUUM

Heat Transfer Oil 600 offers you **6 Big Advantages!**

If your heat transfer requirements go up to 600°F., you'll find that S/V Heat Transfer Oil 600 is by far the *best* medium you can use! S/V Heat Transfer Oil 600 is not just another oil originally intended as a lubricant; it was *specially developed* as a heat transfer medium—the *only* product in the 600°F. range with *all* these advantages:

1. Gives years of trouble-free performance. It's stable—won't deteriorate—costs you far less in the long run because it lasts longer.
2. It's safer because its flash point remains constant. Won't crack at high temperatures... there's no boil-off loss—no vapor lock.
3. Assures lower maintenance costs because it's non-corrosive. This means longer life for all parts of your system—fewer replacements.
4. Eliminates worker complaints—there's no objectionable odor.
5. Eliminates downtime for clean-outs. Won't form carbon or sludge deposits—heat transfer efficiency remains high.
6. You save on power consumption because it's free-flowing. You get easy, fast starts even at low temperatures.

Remember, too, that expert technical service goes with S/V Heat Transfer Oil 600 to help you improve your production—cut costs. Call your Socony-Vacuum man today for full details.

SOCONY-VACUUM OIL CO., INC., 26 Broadway, New York 4, N. Y.,
and Affiliates: MAGNOLIA PETROLEUM CO., GENERAL PETROLEUM CORP.

SEND FOR THIS TECHNICAL BULLETIN

Socony-Vacuum Oil Company, Inc.
26 Broadway, New York 4, N. Y.

Gentlemen:

Please send me your bulletin, "S/V Heat Transfer Oils."

NAME

COMPANY

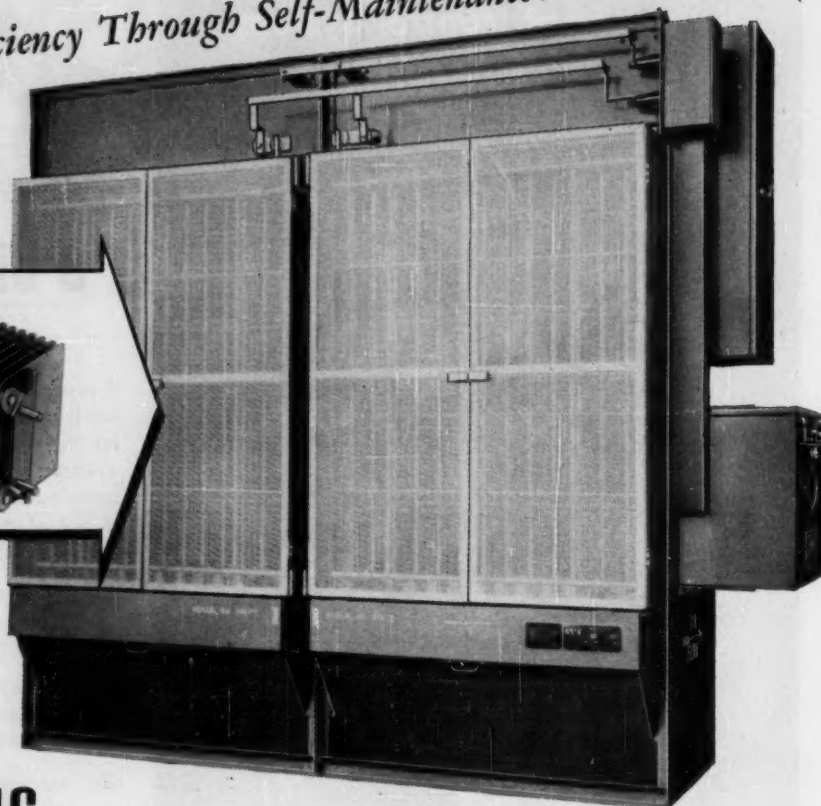
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CITY ZONE STATE

Maintained Efficiency Through Self-Maintenance!



New Model F
ELECTRO-MATIC Collector
plates offer increased surface area
for more even distribution of collected dust.



NEW model F

***Electro*·MATIC**

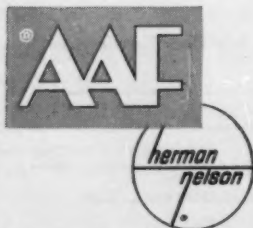
**Delivers Uniformly Clean Air,
Continuously, Around the Clock**

WANT a continuity of clean air that won't vary in quality from one day, month or year to another? It's yours with the Model F ELECTRO-MATIC—the new electronic precipitator whose continuous high efficiency is assured through constant self-cleaning.

The cleaning efficiency of the Model F ELECTRO-MATIC extends over a wide range of particle sizes, from smoke to largest air-borne materials. Its "capacity for work" is increased, too. Newly designed collector plates increase surface area 53% to further reduce possibility of dust build-up and, at the same time, slows down air velocity between plates by 25%.

But here's the payoff! Unlike most other filters, ELECTRO-MATIC's efficiency can't taper off due to the accumulation of dust. Continuous self-cleaning action keeps collector plates in constant fighting trim. There's no time out for washing down with hot water. No need for extra sewer or water connections. ELECTRO-MATIC maintains its own rigid house-keeping schedule without regard to clock or calendar.

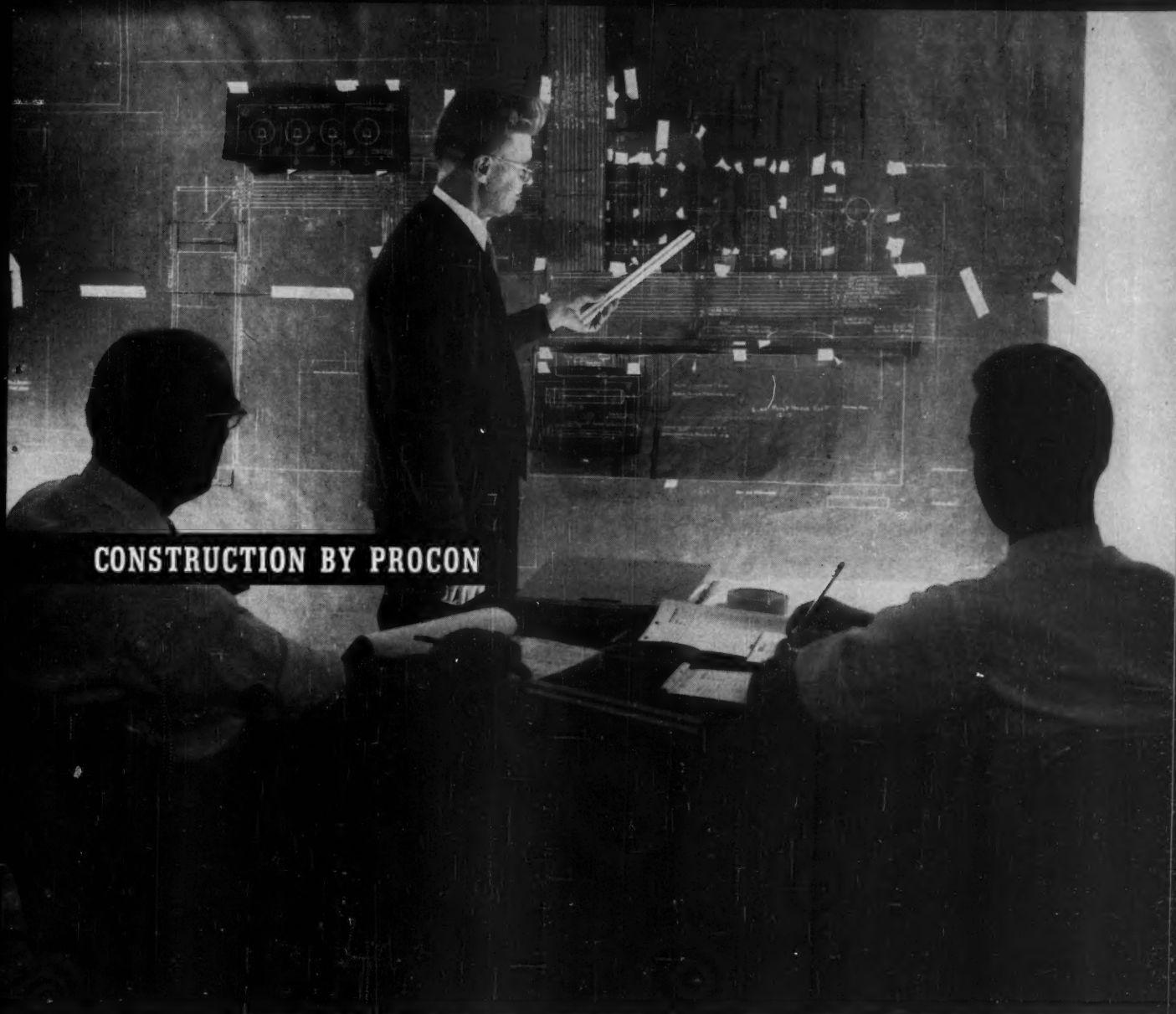
Yes, if performance is the payoff, the Model F ELECTRO-MATIC is definitely today's finest electronic filter. For complete product information, call your local American Air Filter representative, or write for Bulletin 250.



American Air Filter
COMPANY, INC.

American Air Filter of Canada, Ltd., Montreal, P. Q.

326 Central Avenue, Louisville 8, Kentucky



CONSTRUCTION BY PROCON

DESIGN
ENGINEERING
PROCUREMENT
CONSTRUCTION

It's a complex skill, this business of seeing in a blue print the finished project . . . of visualizing the operation of a processing plant from a maze of lines and symbols on a sheet of paper . . . or translating an algebraic equation into the production capacity of a chemical plant.

Yet here at Procon it's all in a day's work. It has to be, for Procon engineers are entrusted with the creating and building of many different types of processing plants. You'll find these men at home in every phase of process construction . . . at the drawing board . . . around the conference table or on the job site. They are typical of the men who are Procon . . . who have been responsible for the recognition which this organization has achieved among leaders of industry.

PROCON *Incorporated*

PROCESS CONSTRUCTION

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Gardner-Denver Maintenance Tools make plant housekeeping easier

Good industrial maintenance often calls for concrete demolition, masonry drilling, heavy lifting, tough digging, firm backfilling — jobs done quickly and easily by the crew that's equipped with these costsaving Gardner-Denver Air Tools —

Write for descriptive bulletin.

GARDNER-DENVER



W8 COMPRESSORS



AIR MOTORS



COMPRESSOR OUTFITS



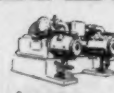
TRAILER COMPRESSORS



CENTRIFUGAL PUMPS



8X COMPRESSORS



15A COMPRESSORS



ROCK DRILLS

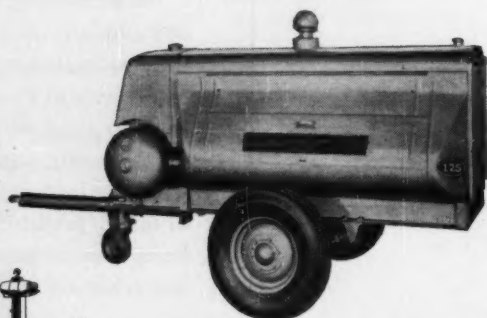


ROLLER AIR NOZZLES AND TOOLS

THE QUALITY LEADER IN COMPRESSORS, PUMPS AND ROCK DRILLS FOR CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY

Gardner-Denver Company, Quincy, Illinois

In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario



The Gardner-Denver WH-125 — puts compressed air where you need it for operating these tools — for cleaning — for paint spraying.



The chips that talk...

To the native savage, whose tribe had no conception of a written language, the piece of wood on which the explorer scribbled a message became the wonderful "chip that talks."

The chips of metal that pour in silver drifts from the mighty machines in Sun Ship's Wetherill plant tell their stories, too. Those shown on the 14-foot boring mill tell part of the story of a fast, thorough repair job on ship-propulsion machinery. That job required lifting a 54-ton section of crankshaft from the ship to a 10 ft. x 50 ft. engine lathe, where

it was checked for trueness and the journals machined. The crankpins were machined in a huge crankshaft machine. The boring mill operation shown was the facing of the webs of a new section which replaced one of the damaged sections of the crankshaft.

That's the kind of story the versatile men and machines at Sun Ship have been writing for decades . . . in building special machinery of every type for the varied industries that are building a greater America.

Sun
SHIPBUILDING & DRY DOCK COMPANY
 ON THE DELAWARE **SINCE 1916** CHESTER, PA.
 25 BROADWAY • NEW YORK CITY

**TYPE F
STEEFLEX
COUPLING**



- Any Size
- Any Service
- Any Application,
Horizontal or Vertical
- Always available

The exclusive grid-groove design of **FALK Steelflex Couplings** protects your machinery in two ways

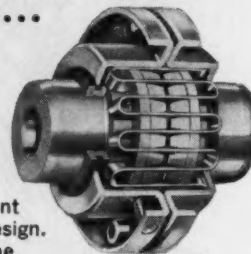
You get double protection when you connect your driving and driven machinery with a Falk Steelflex Coupling—the all-steel-built coupling with the exclusive grid-groove design! First, its torsional resilience smothers shock and vibration; and second, the Steelflex design prevents damage and lowered efficiency by accommodating shaft misalignment.

Why have increasing numbers of key men in industry standardized on Falk Steelflex Couplings? Their experience has proved that Falk Steelflex Couplings prolong the service life of their machinery...are trouble-free and need minimum maintenance...are easy to install, lubricate and disconnect ...and cost less per year of service than ordinary couplings.

One basic Steelflex design—the Type F, in its many sizes—is adaptable to more than 90% of all industrial applications. This facilitates buying, as well as prompt replacing and servicing when necessary. Write to Department 247 for engineering bulletin, including selection and dimension details.

How shock and vibration are smothered by the FALK Steelflex Coupling's Torsional Resilience ...

This cutaway view shows the sturdy all-steel construction, also the exclusive, torsionally resilient grid-groove design. Here is how the grid-groove design functions:



UNDER LIGHT LOADS The gridmember bears only at outer edges of grooves. The long span between points of contact remains free to flex under load variations.



UNDER NORMAL LOADS As load increases, the distance between supports on grooves is shortened proportionately, but a free span remains to cushion shock loads.



UNDER SHOCK LOADS Under extreme overloads, the gridmember bears fully on the grooves and transmits full load directly. The coupling remains flexible, within its rated capacity.



SHAFT MISALIGNMENT ACCOMMODATED Free End Float Permitted

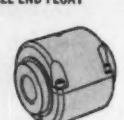
Controlled flexibility in the FALK Steelflex coupling provides compensation for parallel and angular shaft misalignment—and permits free end float for the shafts of the driving and driven members, or of either one.



CM—Reversing Service



H and HH High Speeds



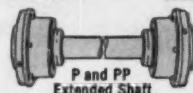
FS—Limited Space



BW—Brakewheel Service



FT—Overload Control



P and PP Extended Shaft

OTHER TYPES AVAILABLE

In addition to the standard Type F (which meets more than 90% of all applications), special or dual purpose Steelflex designs are available for unusual applications. A few of the many types are shown here.

THE FALK CORPORATION, Milwaukee 8, Wisconsin

MANUFACTURERS OF

- | | | |
|------------------------|------------------------|----------------------|
| • Motoreducers | • High Speed Drives | • Marine Drives |
| • Speed Reducers | • Special Gear Drives | • Steel Castings |
| • Flexible Couplings | • Single Helical Gears | • Weldments |
| • Shaft Mounted Drives | • Herringbone Gears | • Contract Machining |

FALK

...a good name in industry



SAVE 3 WAYS With Stainless Steel Containers

You save 3 ways by shipping chemicals in stainless steel containers. First, there isn't the chance of loss by damage in shipment that there is with breakable carboys. The danger of breakage is all but eliminated.

Then, delivered cost per pound or gallon of your chemicals is less because stainless containers are relatively light. Finally there is a big saving in lumber, carpenter's time and general loading costs because stainless containers can be loaded in freight cars with a minimum of bracing.

Stainless steel shipping containers are obtainable in a wide range of capacities and in stainless analyses to suit requirements. For a listing of chemicals shipped and handled in stainless, and names of container manufac-

turers who use Armco Stainless Steels, just fill out the attached coupon and mail it to us.

ARMCO STEEL CORPORATION
4754 Curtis Street, Middletown, Ohio

- ☐ Tell me where I can obtain Armco Stainless Steel containers.
☐ Send me a listing of chemicals shipped in stainless containers.

NAME _____

FIRM _____

STREET _____

CITY _____ ZONE _____ STATE _____

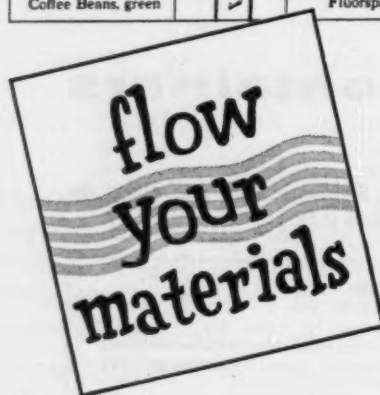
ARMCO STEEL CORPORATION

4754 Curtis Street, Middletown, Ohio



SHEFFIELD STEEL • ARMCO DRAINAGE & METAL PRODUCTS, INC. • THE ARMCO INTERNATIONAL CORPORATION

MATERIAL	FULLER-KINYON	AIRVEYOR	AIRSLIDE	MATERIAL	FULLER-KINYON	AIRVEYOR	AIRSLIDE	MATERIAL	FULLER-KINYON	AIRVEYOR	AIRSLIDE	MATERIAL	FULLER-KINYON	AIRVEYOR	AIRSLIDE
Alum		✓	✓	Coffee Solubles		✓		Fly Ash	✓	✓	✓	Polyethylene		✓	
Aluminum Oxide	✓		✓	Coke Dust	✓		✓	Fuller's Earth	✓	✓	✓	Pyrites	✓		✓
Ammonium Sulphate		✓	✓	Copper Converter Dust	✓		✓	Gilsonite		✓	✓	Quartz, pulverized	✓		✓
Arsenic Oxide	✓	✓	✓	Copra		✓		Gluten Meal		✓		Resins, synthetic		✓	✓
Asbestos Dust		✓	✓	Corn Flakes (brewers')		✓		Grains		✓		Rice		✓	
Asphalt Fillers	✓		✓	Corn Grits		✓		Graphite	✓	✓	✓	Rubber pellets		✓	
Barite	✓		✓	Corn Germ		✓		Gypsum (raw or calcined)	✓	✓	✓	Salt		✓	
Bauxite	✓	✓	✓	Cottonseed Meal		✓	✓	Ilmenite	✓		✓	Salt Cake		✓	✓
Beet Pulp, dried		✓		Cryolite	✓		✓	Iron Salts		✓	✓	Sawdust		✓	
Bentonite	✓	✓	✓	Cyanamid		✓		Lime, hydrated	✓	✓	✓	Seeds		✓	
Bone, steamed		✓		Detergent Powders		✓	✓	Lime, pebble		✓		Semolina		✓	✓
Borax		✓	✓	Dextrin		✓	✓	Lime, pulverized	✓	✓	✓	Shells, pulverized	✓		✓
Brucite			✓	Diatomaceous Earth	✓	✓	✓	Limestone, pulverized	✓		✓	Silica, pulverized	✓		✓
Calcium Carbonate	✓	✓	✓	Dicyandiamide		✓		Litharge			✓	Slag, pulverized	✓		✓
Calcium Phosphates	✓	✓	✓	Dolomite	✓		✓	Magnesite	✓		✓	Slate, pulverized	✓		✓
Carbon, activated		✓	✓	Eggs, dried		✓		Magnesium Oxide	✓	✓	✓	Soap Powders			✓
Carbon Black	✓	✓	✓	Feed Ingredients		✓		Malt		✓		Soda Ash	✓	✓	✓
Catalysts, Petroleum	✓	✓	✓	Feeds, soft		✓		Manganese Dioxide	✓		✓	Sodium Bicarbonate	✓	✓	✓
Cellulose Acetate		✓	✓	Feldspar	✓		✓	Milk, dried		✓		Sodium Phosphates	✓	✓	✓
Cement, Portland	✓		✓	Ferrochrome			✓	Mineral Wool		✓		Starches	✓	✓	✓
Cement Raw Material	✓		✓	Fertilizers	✓	✓	✓	Nylon pellets		✓		Sugars, refined		✓	
Cereals		✓		Flaxseed		✓		Ores, pulverized	✓		✓	Talc	✓	✓	✓
Chalk	✓	✓	✓	Flint	✓		✓	Petroleum Coke (fluid process)			✓	Titanium Dioxide		✓	
Chromite	✓		✓	Flour		✓	✓	Phosphate Rock, pulverized	✓		✓	Wood Chips		✓	
Clays	✓	✓	✓	Flour Premixes		✓	✓					Wood Flour		✓	
Coal, pulverized	✓		✓	Flue Dusts	✓		✓					Zinc Oxide	✓	✓	✓
Coffee Beans, green		✓		Fluorspar	✓		✓								



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BOOTH 1971
NATIONAL
MATERIALS
HANDLING
EXPOSITION
CHICAGO
MAY 16-20



with Fuller Equipment

**FULLER-KINYON . . . AIRVEYOR . . . F-H AIRSLIDES
WILL DO A BETTER JOB FOR YOU**

The above should be of vital interest to everyone concerned with the handling of dry, bulk materials, both for unloading from carriers for delivery to storage, and reclaiming from storage for conveying to innumerable and widely scattered points of process in the plant.

The Fuller-Kinyon System, the Airveyor, or F-H Airslides, or a combination, may very readily be adapted to your plant, whether it be a new or an old one, usually without structural changes or interruption of your production schedule.

Over a quarter of a century of experience in conveying with air, places Fuller engineers in an unequalled position to select the best system, or combination of systems, to do the work most efficiently and economically.

We will gladly welcome the opportunity to make a study of your conveying problems and submit our recommendations for the betterment of your operation . . . without any obligation, of course. Write for Bulletin G-1, illustrating and describing air-conveying systems built by Fuller.

FULLER COMPANY, Catasauqua, Pa.

GENERAL AMERICAN TRANSPORTATION CORPORATION SUBSIDIARY

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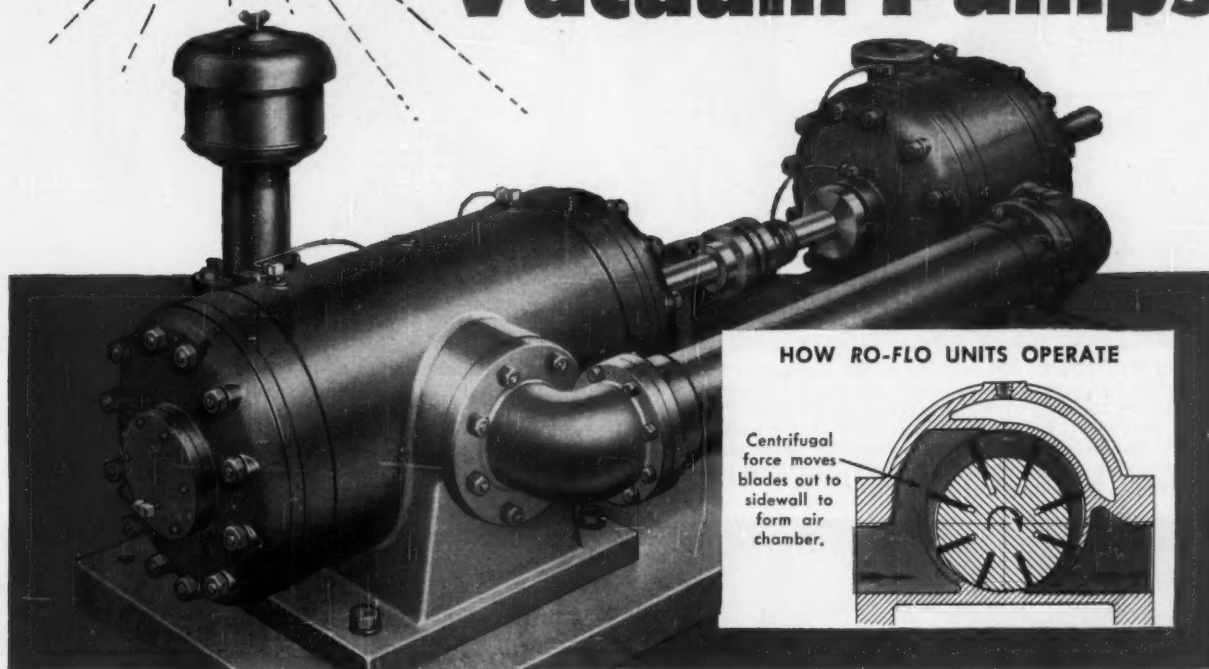
G-108
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NEW

ALLIS-CHALMERS

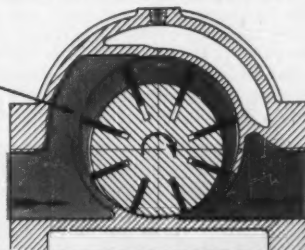
100-lb Compressors

0.3-in. Mercury Absolute Vacuum Pumps



HOW RO-FLO UNITS OPERATE

Centrifugal force moves blades out to sidewall to form air chamber.



FOR SHOP AIR • DRILLING • GAS HANDLING • VACUUM PUMPING

Now—the *Ro-Flo* line is extended to include high pressure as well as low pressure units to give you three important advantages:

Constant efficiency — Automatic compensation for wear is inherent in *Ro-Flo* design. During operation, rotor blades slide against the sidewall to form air cells. Any blade wear from this action is compensated for by the rotating force which holds blades in contact with the cylinder.

Simple foundation requirements — The smooth rotation of the *Ro-Flo* unit cuts vibration and eliminates need for heavy, expensive foundations.

Low maintenance — Shock and vibration, inherent in reciprocating machines, is eliminated. This cuts maintenance.

Two-stage *Ro-Flo* compressors can be furnished in any of 12 sizes to handle from approximately 250 to 1800 cfm at pressures from 65 to 125 pounds gauge. Vacuum pumps furnished from 200 to 5040 cfm at 29.7 inches Hg vacuum, with shut-off of 29.9 inches Hg, referred, or better. Single-stage units are built for pressures up to 50 pounds gauge, 65 pounds absolute. Single-stage pumps for vacuums up to 28 inches Hg referred.

A-4569

GET INFORMATION

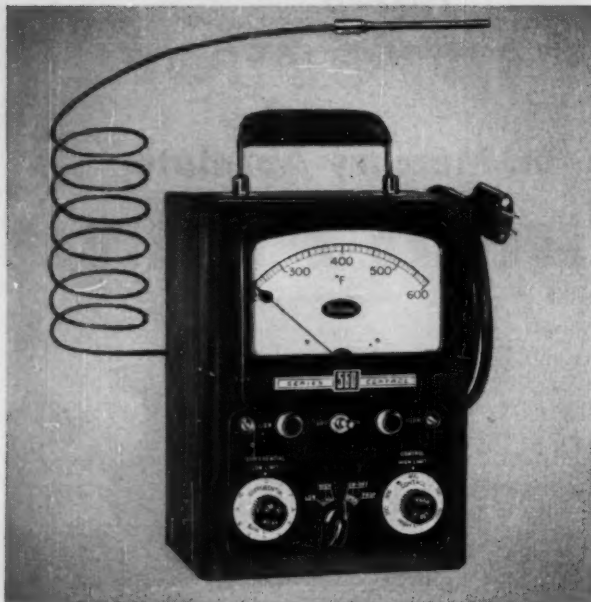
Call your nearby A-C district office, or write Allis-Chalmers, Milwaukee 1, Wisconsin.

Ro-Flo is an Allis-Chalmers trademark.

ALLIS-CHALMERS



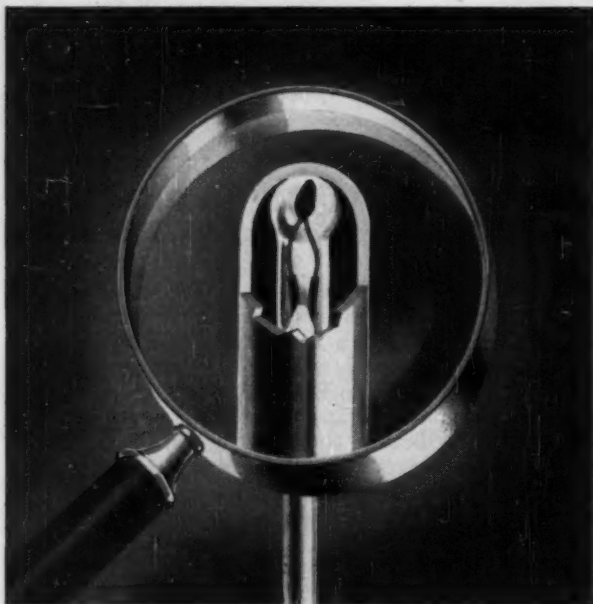
Which of these two instruments provides the temperature control accuracy you need?



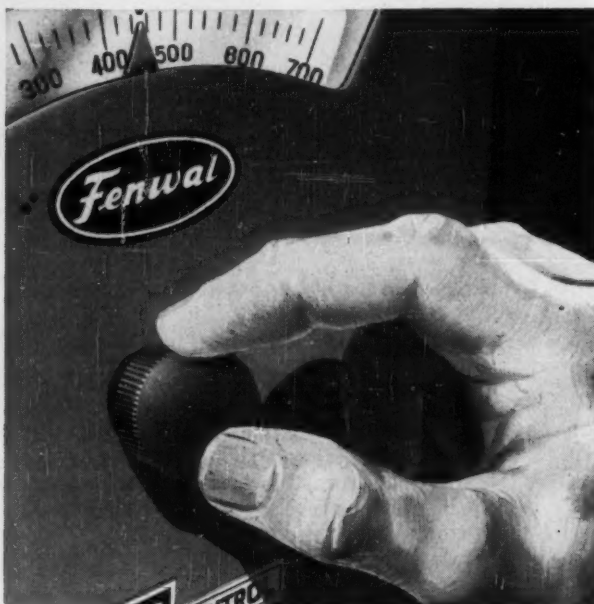
1. IT'S ELECTRONIC! The new Series 560 applies the thermistor principle in temperature indicator controls with heretofore unattainable accuracy over a scale range of 200° to 600°F. It's the *only* instrument that provides the three major control modes — (1) on-off (2) proportional (3) adjustable differential — all at the flip of a switch. Wide range of use for general laboratory, processing, molding or packaging applications.



2. IT'S MECHANICAL! The new Series 540 indicating controller combines low cost with high accuracy over a temperature range of 100° to 700°F. Temperature changes are transmitted by a bulb and bellows to an indicator control. Instrument features on-off control . . . adjustable differential . . . ambient compensation. May be flush or surface mounted. Capacity of 15 amps at 115 volts.



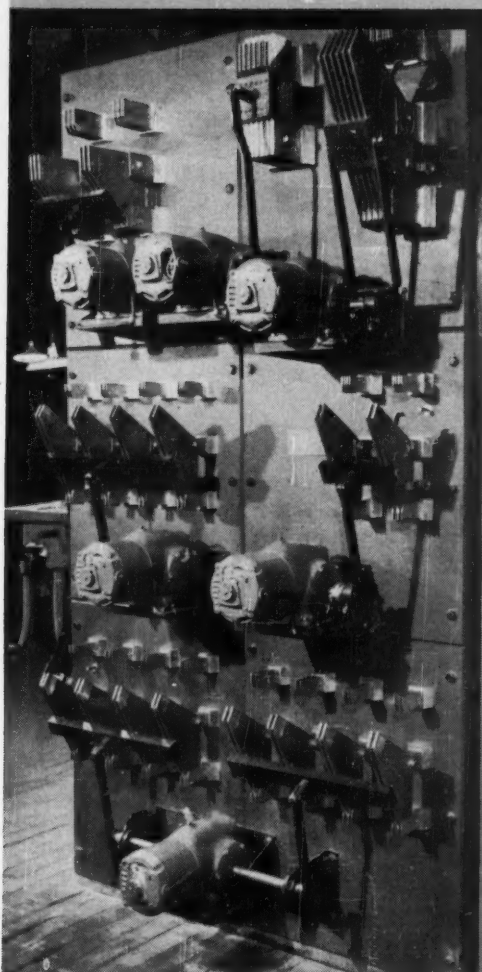
3. SIMPLICITY ITSELF is secret of Fenwal's Series 560 — accuracy, sensitivity and ruggedness. The thermistor's high resistance change permits operation with any length of lead wire up to 200 feet without affecting signal strength or accuracy. Thermistor is hermetically sealed in glass for stability; encased in stainless steel for ruggedness. No complex circuitry; maintenance is easy.



4. EASY "SET" AND "CHECK" OPERATION is a feature of Fenwal's Series 540 which is accurate to within 2% over the 100° to 700°F range, including the effects of ambient temperatures. Send for **FREE NEW BULLETINS**, MC122 on the Series 540, MC123 on the Series 560. Both contain full data you should have. Write to Fenwal Incorporated, 165 Pleasant St., Ashland, Mass.

Fenwal Controls Temperature . . . Precisely

Geared for smooth, slow speed



SIX

Century

Performance-Rated®

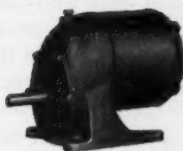
GEAR MOTORS

power this remote controlled Automatic Switch. These gear motors are $\frac{1}{3}$ H.P., 5 r.p.m., right angle shaft.

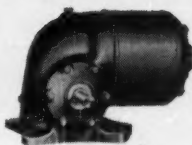
Whatever your slow speed needs... from 4.3 to 780 r.p.m. ... Century Gear Motors provide compact, quiet-running units hardly larger than conventional motors... in ratings from $\frac{1}{8}$ to 150 H. P.

For quiet, dependable service, helical gears with "rotational tooth contact" help prevent uneven wear and minimize vibration. Extra-width pinions provide strength for greater shock load resistance and longer life.

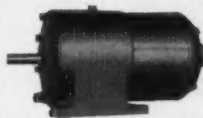
Tapered roller bearings enable the gear shafts to withstand radial and thrust loads without strain on the motor. Oil tight shaft seals make these motors particularly adaptable to shaft-down mountings on processing jobs where contamination is a problem. Whatever the speed and power characteristics you need... AC or DC... Century Motors are Performance-Rated to do the job with top efficiency. For information, call your nearby Century Sales Office or Authorized Distributor.



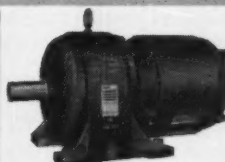
Parallel shaft, single reduction... 280 to 780 r.p.m. ... $\frac{1}{8}$ to 150 H.P.



Right angle shaft, single reduction... 25 to 280 r.p.m. ... $\frac{1}{8}$ to 3 H.P.



Parallel shaft, double reduction... 37 to 280 r.p.m. ... $\frac{1}{8}$ to 150 H.P.



Parallel shaft, triple reduction... 7.5 to 37 r.p.m. ... 1 to 150 H.P.



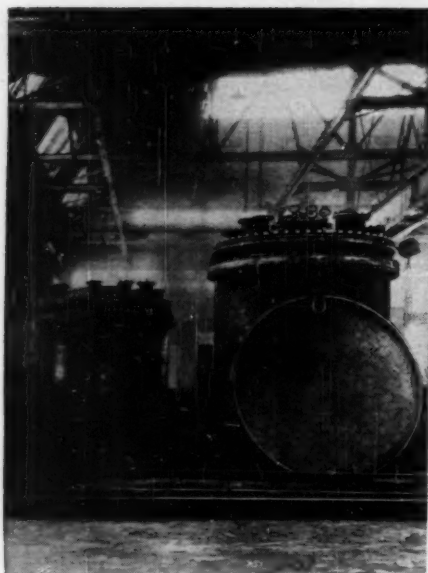
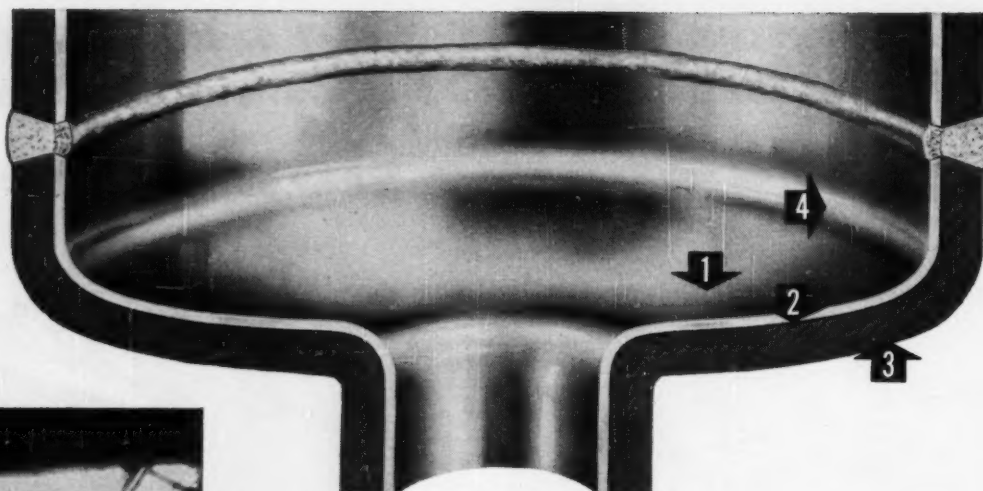
Right angle shaft, double reduction... 4 to 84 r.p.m. ... $\frac{1}{8}$ to $\frac{3}{4}$ H.P.

Performance-Rated® Motors
 $\frac{1}{8}$ to 400 H. P.



CENTURY ELECTRIC COMPANY

1806 Pine St. • St. Louis 3, Mo. • Offices and Stock Points in Principal Cities



These chemical reaction tanks were fabricated from wide plates of Nickel-Clad Steel.

- 1. ECONOMY**—High-alloy layer—usually 10% or 20% of total plate thickness—assures corrosion and abrasion resistance, long equipment life.
- 2. DESIGN FREEDOM**—Integral bond allows design and fabrication of shapes to meet process and space needs.
- 3. STRUCTURAL STABILITY**—Carbon or alloy steel backing gives required strength and rigidity at lower cost.
- 4. LESS MAINTENANCE**—Smooth, hard surfaces, rounded corners and sloping bottoms mean easy cleaning and draining.

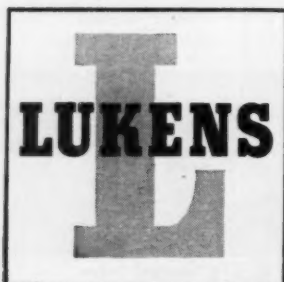
CLAD STEEL EQUIPMENT IS **EASIER** TO CLEAN AND MAINTAIN

Where cleaning and maintenance problems hamper continuous operation, slow down process change-overs or run production costs up, corrosion-resistant clad steel equipment can provide the *economical* solution. Clad's smooth, high-alloy surfaces are virtually maintenance-free, often need only to be flushed with water. Where drastic cleaning methods must be used, the clad surfaces won't chip or peel. Because of the permanent bond between cladding and backing, tanks and vessels may be designed with the rounded corners and sloping bottoms that assure quick, easy drainage.

There are sixteen Lukens' Clad Steels—various types of stainless, nickel, Inconel, Monel, copper. They give you corrosion and abrasion resistance, protect product purity to the same degree

as solid high alloys with savings of up to 50% in material costs. The ASME Code permits full gage consideration for design purposes because cladding and backing are bonded over their entire surface.

To get these benefits, plus long life under pressure, vacuum or thermal cyclical service, fast heat transfer and easy modification when processes change, ask *qualified* builders about clad steel equipment. These men are experts, understand your problems, and will work with your engineers and consultants. We offer the widest selection of clad steels available anywhere and we can help in the selection of the type of clad steel that best suits your needs. If you would like more information, consult one of your equipment builders, or write Manager, Marketing Service, Lukens Steel Co., 749 Lukens Building, Coatesville, Pa.



LUKENS

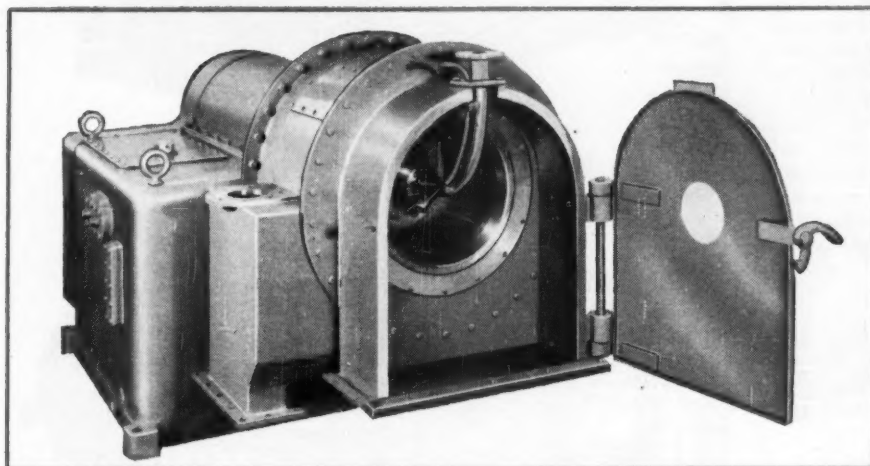
CLAD STEELS

STAINLESS-CLAD • NICKEL-CLAD • INCONEL-CLAD • MONEL-CLAD

PRODUCER OF THE WIDEST RANGE OF TYPES AND SIZES OF CLAD STEEL PLATES AND HEADS AVAILABLE

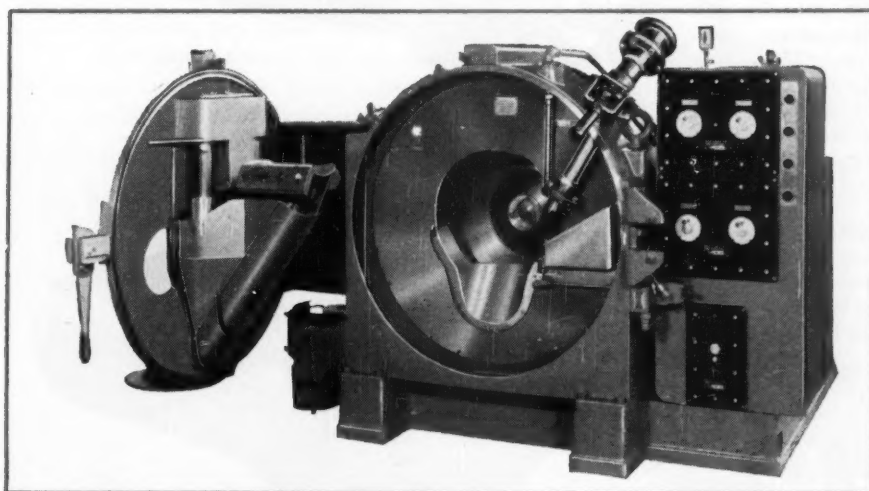
**GET EFFICIENT
CENTRIFUGATION
OF FILTERABLE
SLURRIES WITH
BAKER PERKINS
CENTRIFUGALS**

These two types of Baker Perkins centrifugals will handle practically any kind of filterable slurry. The Type S Continuous and the Type HS Universal Filtering Centrifugal are available in a wide range of capacities, and all units are low in power requirement and operating cost. A B-P sales engineer is a specialist in centrifugation so why not let him help you with your product problems. Write, or call us today.



**B-P TYPE S CONTINUOUS
CENTRIFUGAL**

This machine is designed for slurries of relatively coarse crystalline, granular, or fibrous solids.



**B-P TYPE HS UNIVERSAL
FILTERING CENTRIFUGAL**

This is designed for slurries of solids finer than 100 mesh, with high or low viscosity liquid phase.

BAKER PERKINS INC.

CHEMICAL MACHINERY DIVISION • SAGINAW, MICHIGAN

304

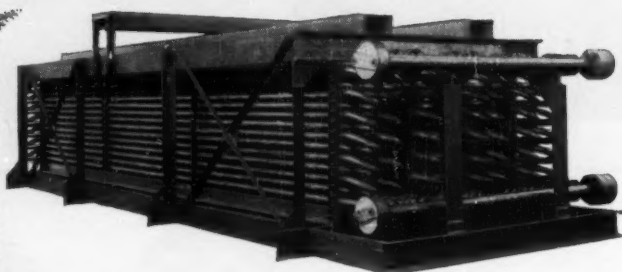
AMMONIA CONDENSERS...

**STANDARDIZED IN DESIGN
PROVED IN PERFORMANCE**

CASCADE TYPE

for water — ammonia service

This cascade condenser, operating with water over the outside of the individual zig-zag coils, was designed for an ammonia pressure of 5,200 psig. The unit is furnished complete with frame work and catwalk as well as water distributing piping and necessary troughs. While the unit as shown is wholly constructed of steel, other designs with copper-clad steel or galvanized steel coils and headers are available when heavy corrosion on the water side is expected. This compact, standardized design is promptly available, efficient in use, and easy to maintain.

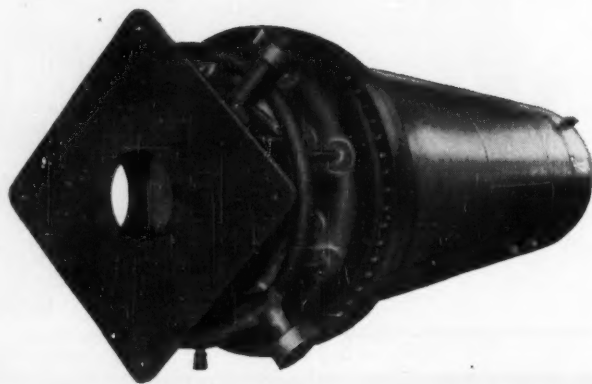
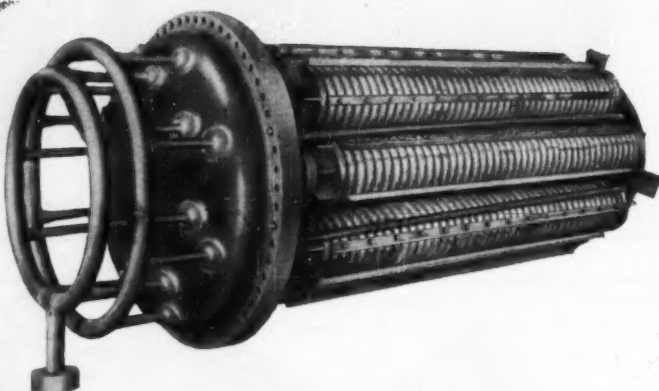


SHELL-and-COIL TYPE

for ammonia — ammonia service

The coils in this condenser are closely wound nested helicals with manifolds arranged as shown. The shell side design pressure is 165 psig and the coil side 5,200 psig. This unit has proved exceptionally economical to operate and maintain and its standardized construction, eliminating special engineering, assures lowest equipment cost.

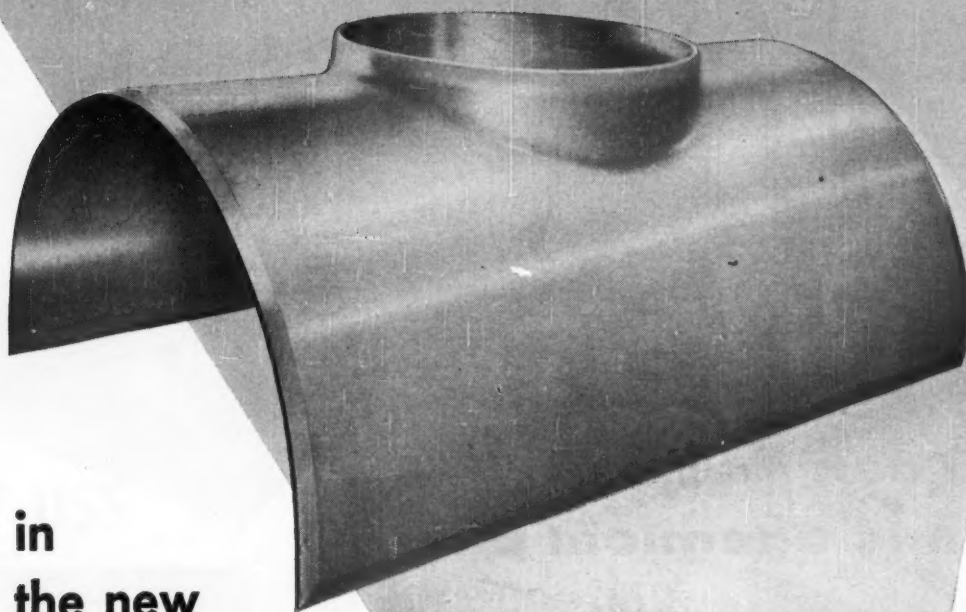
Whatever your heat exchanger problem, ask us for recommendations. Our long experience is at your service. The Whitlock Manufacturing Company, 94 South Street, West Hartford 10, Conn. In Canada: Darling Bros., Limited, Montreal.



Whitlock

Designers and builders of bends, coils, condensers, coolers, heat exchangers, heaters, piping, pressure vessels, receivers, reboilers.

Here's what we mean by **FLUED DOME**



in
the new
QCF-built

DURADOME tank car

Notice that *smooth, unbroken curve* at the base of the dome—and the extra heavy-gauge steel throughout the full top center section. What used to be the weakest part of the tank car is now the strongest! It took a giant new million-dollar press to make that curve possible. Never before could a full top-center section of a steel tank car be perfectly *flued* to eliminate the weaknesses found in old-fashioned dome construction.

Only DURADOME tank cars give you the advantages of: *much easier cleaning . . . far better application of lining . . . greatly increased structural strength . . . unequalled resistance to corrosion.*

But there's more to the story—much more! Ask your Shippers' representative about the new *standardized underframe . . . all-welded insulation jacket . . . pressure-type construction.* You have a world of new benefits—at no extra cost—in the new, years-ahead DURADOME!

Specialists for over 35 years in the leasing, operation, maintenance and servicing of tank car fleets—now exclusive sales agent of QCF tank cars for industry.

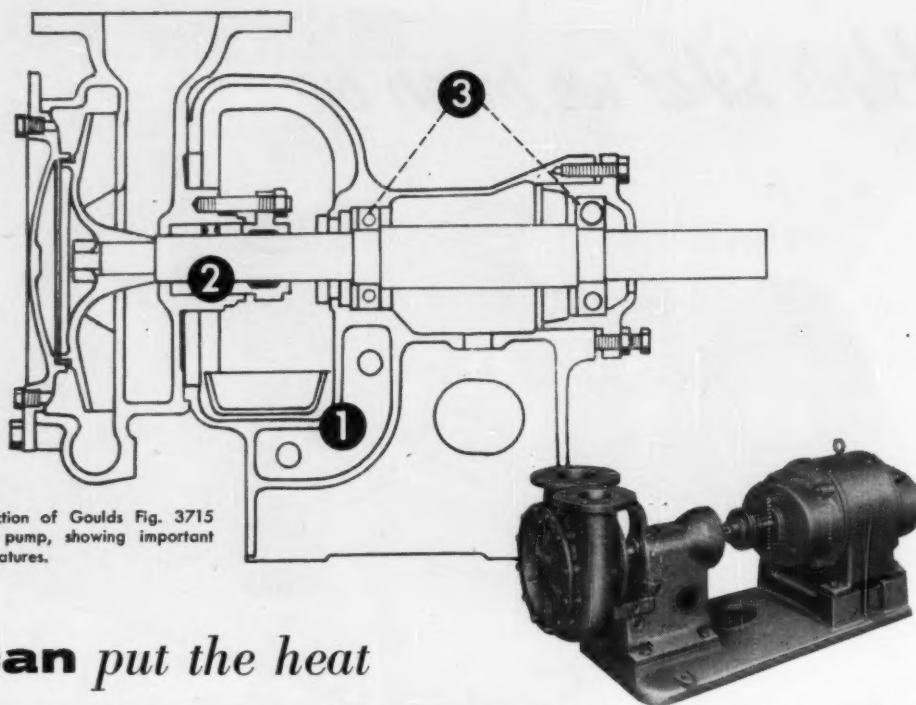


SHIPPERS' CAR LINE CORPORATION

30 Church Street, New York 7, N. Y.

A subsidiary of QCF INDUSTRIES Incorporated

Chicago, Ill. • Houston, Tex. • San Francisco, Cal. • Milton, Pa. • East St. Louis, Ill. • Smackover, Ark. • Tulsa, Okla. • North Kansas City, Mo.



Cross section of Goulds Fig. 3715 chemical pump, showing important design features.

You can put the heat on this chemical pump

Handling hot, corrosive, or abrasive liquids is what the Goulds Fig. 3715 pump is built for.

You can run this pump at 350° F. by cooling the support head (1) and quenching the gland, through fittings that are built in.

And you can get the pump in a variety of materials to meet your particular liquid-handling needs—type 316 stainless steel, Gould-A-Loy 20 (equivalent to ACI CN 7M CU), all bronze, bronze-fitted, all iron, or iron or bronze with stainless trim. These materials regularly stocked—other material can be furnished on order.

Wide range of sizes

There's a size, too, to meet most requirements—nine sizes in all, providing capacities up to 720 GPM, and heads to 200 ft.

Whatever size and construction material you need, you can be sure that your Goulds Fig. 3715 pump will operate with high efficiency and low maintenance cost.

Mechanical seals available

The stuffing box (2) is on the suction

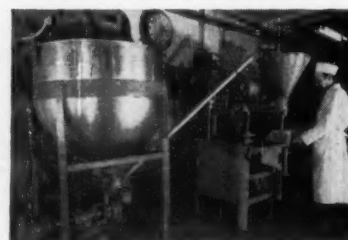
side of the impeller, subject to suction pressure only. Or we can equip your pump with either a single or double mechanical seal. Completely sealed bearings (3) keep out dirt and moisture, and are grease lubricated.

You can inspect and clean the interior of the pump, or remove and replace the impeller, without disturbing piping connections. You can adjust axial clearance between the impeller vanes and the casing by external means.

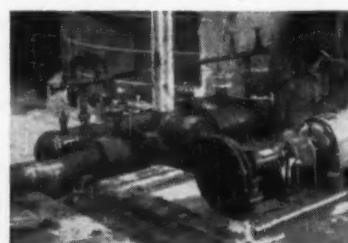
Interchangeability of parts

And you can keep your parts inventory low, for many of the parts are standardized for interchangeability between sizes. For example, you need only two different shafts for all 9 sizes of Fig. 3715 pumps.

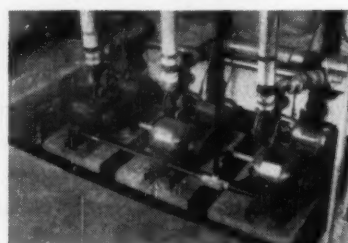
We'd like to send you additional details about these chemical pumps. Just drop us a line, asking for Bulletin 725.4. It gives performance curves, sizes and specifications. Or, if you have a pumping problem of any kind one of our representatives will be glad to consult with you about it.



Goulds stainless steel pump handling corn meal mush in a food plant.



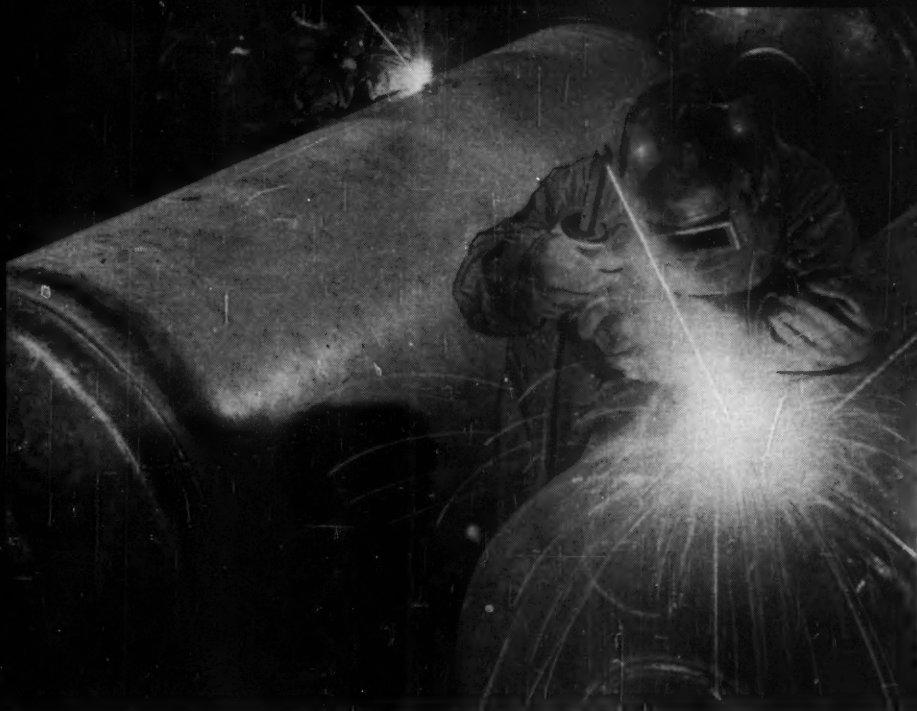
This Goulds chemical pump is handling hot fatty acids in an oil processing plant.



These three Goulds chemical pumps circulate hot size in a textile plant.



ATLANTA • BOSTON • CHICAGO • HOUSTON • NEW YORK • PHILADELPHIA • PITTSBURGH • TULSA



WELDMENTS of "T-1" Steel—made with AWS 12015 low hydrogen coated electrodes and without pre- or post-heating—develop the full 90,000 psi yield strength. As a result, lightweight designs are completely safe and reliable.

NEW USS "T-1" STEEL has great potential for reducing cost of pressure vessels

You've heard of Operation "T-1." You've heard how those dramatic tests proved that, when and if higher design stresses are permitted, USS "T-1" constructional alloy plate steel will make possible larger, stronger pressure vessels, vessels that can be built more easily and at lower over-all cost. As a result of Operation "T-1," several major pressure vessel fabricators have requested approval from the ASME to use USS "T-1" Steel in unfired pressure vessels. Why? For mighty good reasons:

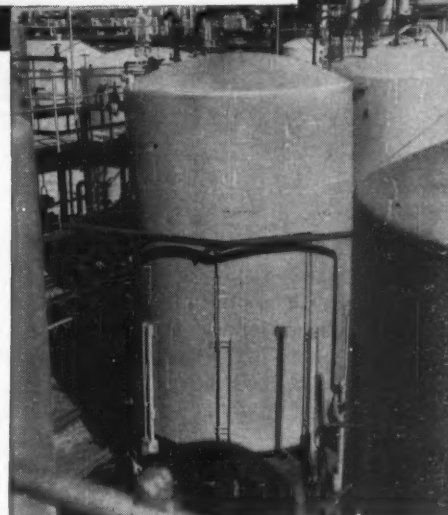
"T-1" Steel has a very high yield strength — 90,000 psi minimum — three times that of conventional plate steels now used in pressure vessels. Yet it is extremely *tough* and can withstand high stresses and pressures even at temperatures far below zero. What's more, USS "T-1" Steel remains strong at *high* temperatures up as high as 900 degrees F.

Yet, "T-1" Steel is easy to fabricate. It can be drilled, machined, or cold formed, and welded or flame-cut *without* pre- or post-heating. **"T-1" can make pressure vessels . . .**

LARGER. For a given pressure and shell thickness, the *radius* of a vessel may be increased in direct proportion to the ratio of working stresses. Result: more storage capacity at lower cost.

STRONGER. For a given radius and shell thickness, the *pressure* may be increased in proportion to the ratio of working stresses. Result: vessels for higher pressures at lower cost.

LIGHTER, EASIER TO BUILD. For a given pressure and radius, the shell thicknesses may be reduced, thus permitting larger vessels to be fabricated *without stress relief*. Result: lower fabrication cost.



United States Steel, Room 4660
525 William Penn Place, Pittsburgh 30, Pa.

☐ Please send me your booklet "United States Steel presents T-1" which contains the full story of "T-1" steel.

☐ Have your representative get in touch with me.

Name

Address

City State

UNITED STATES STEEL CORPORATION, PITTSBURGH • COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. • UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS **"T"** CONSTRUCTIONAL ALLOY STEEL

SEE THE UNITED STATES STEEL HOUR. It's a full-hour TV program presented every other week by United States Steel. Consult your local newspaper for time and station.



UNITED STATES STEEL

TRY ONE IN THE LINE AND YOU'LL SEE WHY

Specifying Hancock Bronze Valves means big savings in your valve investment

The economy of Hancock "500 Brinell" Bronze Valves has been proved by industry . . . in piping systems similar to yours. Users rate them No. 1 because Hancock Bronze Valves are built with quality materials and design features that save money on valve investment. Put one in the line and the demonstrated savings will lead you to specify Hancocks from then on.

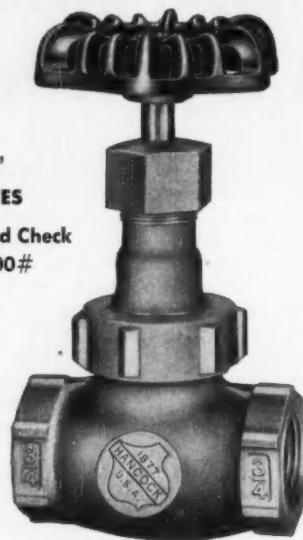
Here's why they cut costs! Seat and disc are super-hard "500 Brinell" stainless steel, formed for tight bottom seating under compression, without tension. No leaks! No wire drawing, galling, steam cutting! The rugged diaphragm is 125 to 230% stronger than in the usual bronze valve. Long-wearing silicon bronze is machined into a large diameter stem with Acme thread to assure straight-line rigidity and smooth operation. A practical back-seating design makes it easy to pack the Hancock Bronze Valve under pressure.

When Hancocks go in, valve costs go down.

HANCOCK "500 BRINELL" BRONZE VALVES

Globe, Angle and Check
150#, 200#, 300#

Sizes: 1/4" Thru 2"



YOUR INDUSTRIAL SUPPLY DISTRIBUTOR of premium-quality Hancock Bronze Valves will gladly help you pick the right valve to produce maximum savings, or write for Bulletin 260.

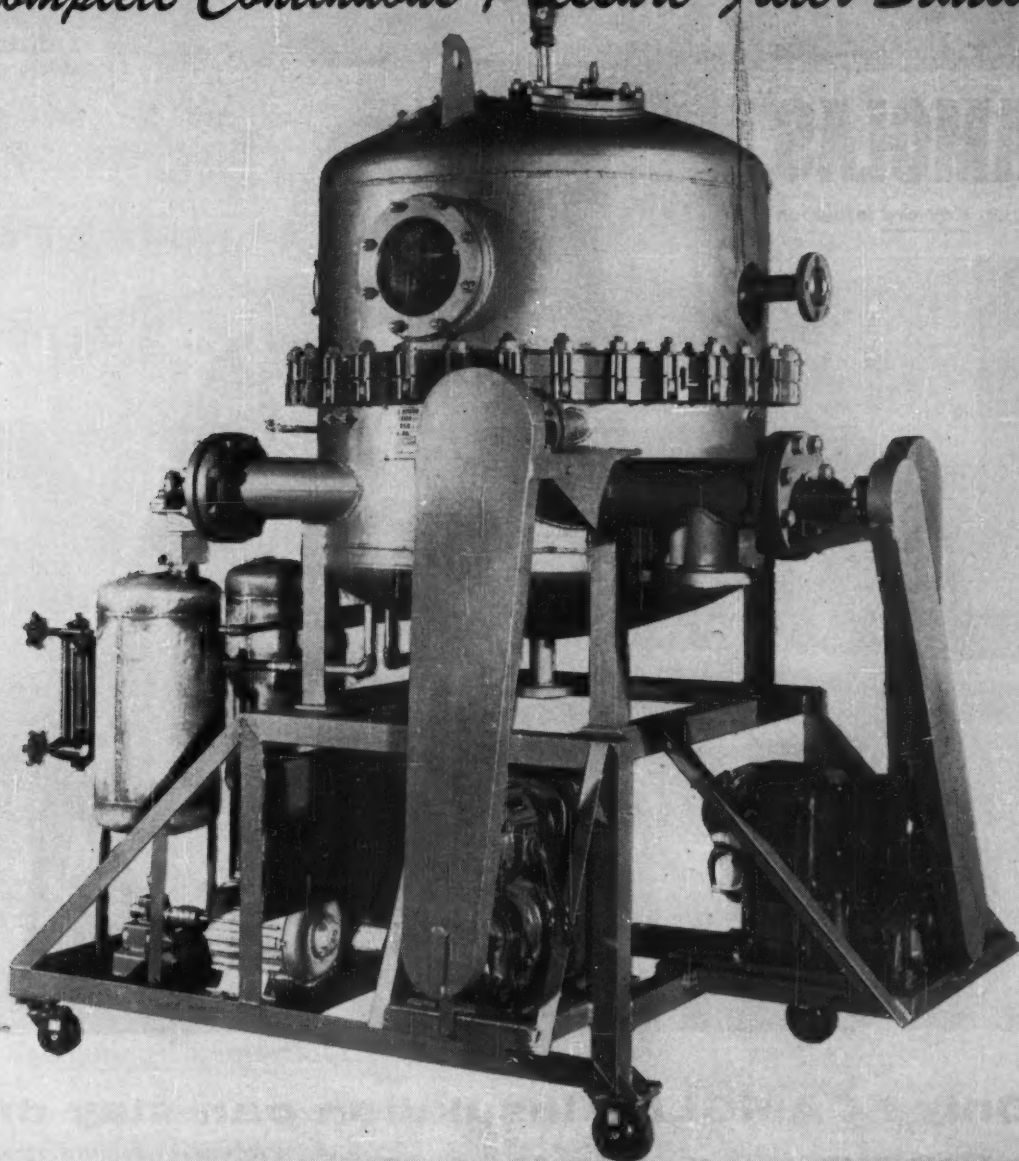
In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario

HANCOCK VALVES

A product of **MANNING, MAXWELL & MOORE, INC.** Watertown 72, Massachusetts

MAKERS OF 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'ASHCROFT' GAUGES, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, Stratford, Conn. 'CONSOLIDATED' SAFETY RELIEF VALVES, Tulsa, Okla. AIRCRAFT CONTROL PRODUCTS, Danbury, Conn. and Inglewood, Calif. "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, Muskegon, Mich.

Complete Continuous Pressure Filter Station



Liquid-solids separation through a pressure-vacuum differential has many applications in chemical processing.

Eimco designed, tested and approved pressure vessels of this type have found wide acceptance in many different kinds of jobs. Some of these use heat and others use inert gas. Some of the jobs involved combustible materials and others non-combustibles.

All of the installations are classified as far as Eimco is concerned to protect the customer's process or his idea and his flow sheet.

Eimco was selected in each case because Eimco's experience in the field of filtration is unsurpassed and Eimco's ability to engineer into each filter that extra quality that provides for greater product recovery and greater profits for the user.

Let Eimco's Research and Development Center tackle your filtration problem. You will have the benefit of work by some of the best technologists in the industry, plus complete pilot plant data. Eimco backs the recommendations of its Research Center by a guaranteed performance.

THE EIMCO CORPORATION

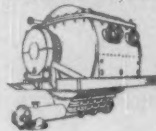
Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Texas Birmingham, Ala. Duluth, Minn. Kalamazoo, Mich. Baltimore, Md. Pittsburgh, Pa. Pasadena, Calif. Houston, Texas London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa

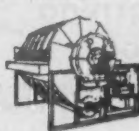
BURWELL



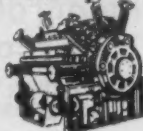
CONTINUOUS PRESSURE



AGIDISC



BI-CARB



PRESSURE PRECOAT



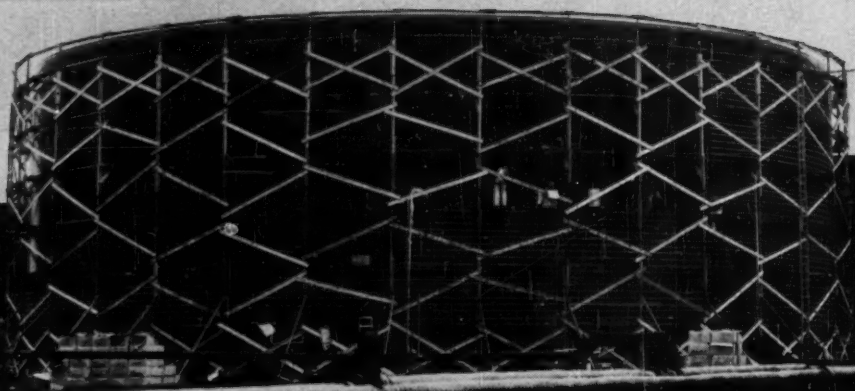
PAN



B-103

FOAMGLAS®

the cellular, stay-dry insulation



Only FOAMGLAS insulation can stay dry at 120°F on these fuel oil storage tanks

FUEL OIL CORPORATION officials faced a serious problem when their supply of steam needed to heat heavy fuel oil at River Rouge, Michigan was curtailed. They solved it by insulating their four massive storage tanks with FOAMGLAS to cut the volume of steam required to heat the oil. They say:

"We picked FOAMGLAS because it can't absorb the moisture that cuts insulating efficiency. This was most important since the 120°F temperature of the stored oil could not dry out moisture that might be absorbed by ordinary insulations. With FOAMGLAS, we get constant insulating efficiency to keep oil heating steam requirements at a money-saving minimum.

"We save money, too, because we get this lasting insulating protection without high insulation replacement and maintenance costs. Even oil spillage and corrosive industrial atmospheres can't damage fireproof, acid-proof FOAMGLAS."

It will pay you to find out today how you, too, can save money by using FOAMGLAS. Write for our booklets on insulation for piping, tanks and other equipment.

Pittsburgh Corning Corporation

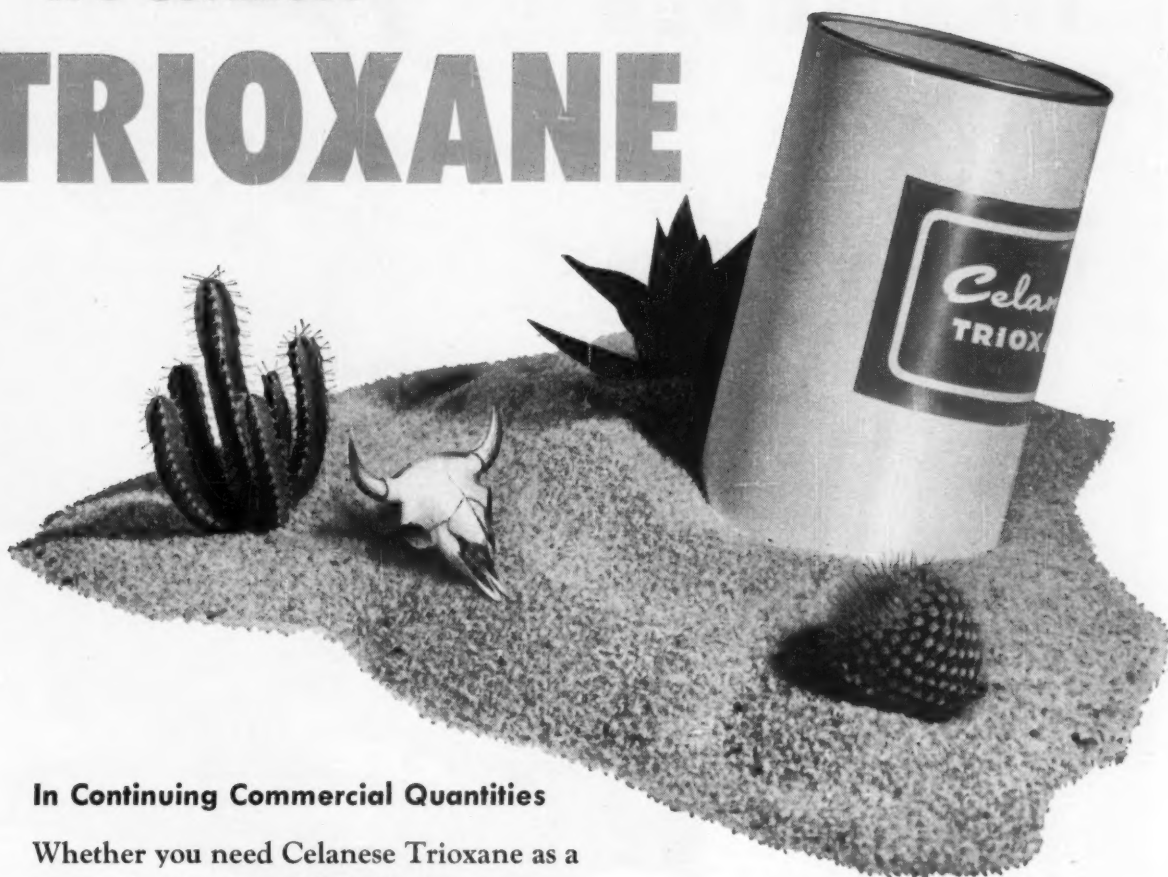
Department H-55, One Gateway Center
Pittsburgh 22, Pennsylvania
In Canada: 57 Bloor St. W., Toronto, Ontario

Flat 2" blocks of FOAMGLAS are applied to surface of 117' dia., 41' high tank. Blocks were banded in place then sprayed with coat of asphalt cutback. Insulation Contractor was G. H. Gotshall Co., Detroit, Michigan.



formaldehyde isn't "formaldehyde" any more
for an anhydrous source
it's Celanese*

TRIOXANE



In Continuing Commercial Quantities

Whether you need Celanese Trioxane as a source for dry formaldehyde gas . . . as a stabilizer for trichloroethylene solutions . . . as an electroplating bath constituent . . . or as a component for the azeotropic separation of hydrocarbon mixtures, you're always assured of commercial quantities.

We'll be glad to help your development work with samples and technical guidance.

Write to

Celanese Corporation of America,
Chemical Division, Dept. 553-E
180 Madison Avenue, New York 16.

Celanese*
CHEMICALS

*Reg. U. S. Pat. Off.



Only Celanese offers the right formaldehyde for every purpose

PARAFORMALDEHYDE • FORMCEL® SOLUTIONS • FORMALIN TRIOXANE

Here's the **PUMP** for hot jobs like these



ALLIS-CHALMERS oil-lubricated pumps have excellent service records on many types of high temperature applications like those shown here. This pump is of simple design, yet has all the features required for low cost, low maintenance operation at high temperatures.

Check the design and construction features that make this possible:

- Built in a wide range of ratings . . . capacities to 3500 gpm, heads to 400 feet.
- Available in wide choice of materials, including iron, bronze, aluminum bronze, stainless steel, high nickel alloys and others.

- Jacketed casing and stuffing box and water-cooled bearings optional.
- Adaptable for packing, mechanical seal or both.
- Simple, accessible design makes maintenance easy.

Allis-Chalmers can supply you with a complete pumping unit — pump, motor and control — all of coordinated design and manufacture and delivered assembled and ready to install. Get complete information from your Allis-Chalmers District Office, or write Allis-Chalmers, Milwaukee 1, Wisconsin, and ask for Bulletin 52B7638.

A-4656

ALLIS-CHALMERS



It pays to...

Dry Natural Gas

with Davison Silica Gel!

Data Proves That Silica Gel Is Best Drying Agent For Natural Gas

Field performance data shows that Davison Silica Gel is the superior drying agent for natural gas. No other drying agent offers all the advantages to be found in Davison Silica Gel.

- High capacity for moisture
- Resistance to fouling gives long desiccant life
- Economical to use because of fewer reactivations
- Dries to lower dew point
- High capacity at elevated temperatures—110-120°F.
- Excellent attrition resistance
- Low pressure drop

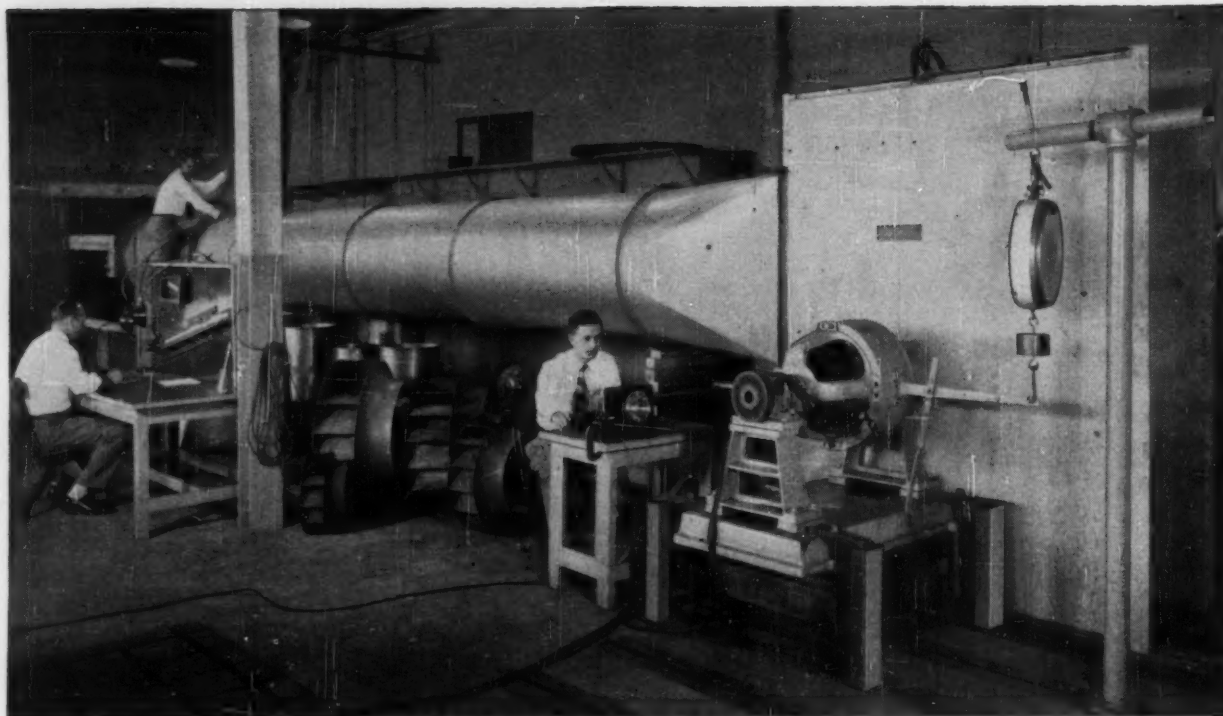
For detailed information and field performance data on the use of Davison Silica Gel for the drying of natural gas, write for Technical Bulletin No. 201.

Progress Through Chemistry

DAVISON CHEMICAL COMPANY

Division of W. R. Grace & Co.
Baltimore 3, Maryland

PRODUCERS OF: CATALYSTS, INORGANIC ACIDS, SUPERPHOSPHATES, TRIPLE SUPERPHOSPHATES, PHOSPHATE ROCK, SILICA GELS AND SILICOFLOURIDES.
SOLE PRODUCERS OF DAVCO® GRANULATED FERTILIZERS.

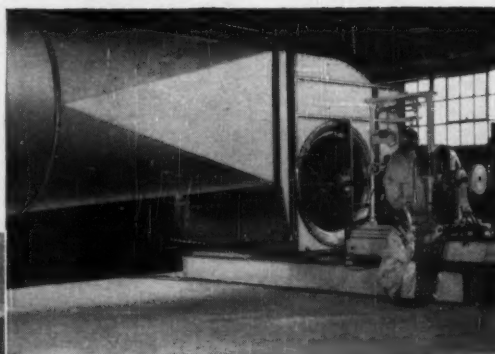


Testing fan wheel performance in the "Buffalo" Laboratory

WHY "BUFFALO" FANS PERFORM* AS SPECIFIED

What will this wheel design deliver at various static pressures? What are the horsepower requirements? Noise level? And what's the best housing? Endless testing like this in the "Buffalo" Laboratory—plus endless designing and redesigning—brought you the famous high-performance Type BL Limit-Load Ventilating Fan—and will continue to bring you the latest and finest in fans. You can expect this inbuilt performance whenever you order a "Buffalo" Centrifugal, axial flow or propeller fan.

WHERE WE TRY TO DESTROY WHEELS—the "Buffalo" vacuum test pit where wheels are revolved at many times their operating speeds to discover—and correct—any point of structural weakness. Further assurance of a better fan buy when you specify "Buffalo".



ALL TESTS in the complete "Buffalo" laboratory are conducted in strict accordance with the test code adopted jointly by NAFM and ASH&VE.

*Performance—another term for the "Buffalo" "Q" Factor—the built-in Quality which provides trouble-free satisfaction and long life.



BUFFALO FORGE COMPANY

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BUFFALO, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Sales Representatives in all Principal Cities

VENTILATING

AIR CLEANING

AIR TEMPERING

INDUCED DRAFT

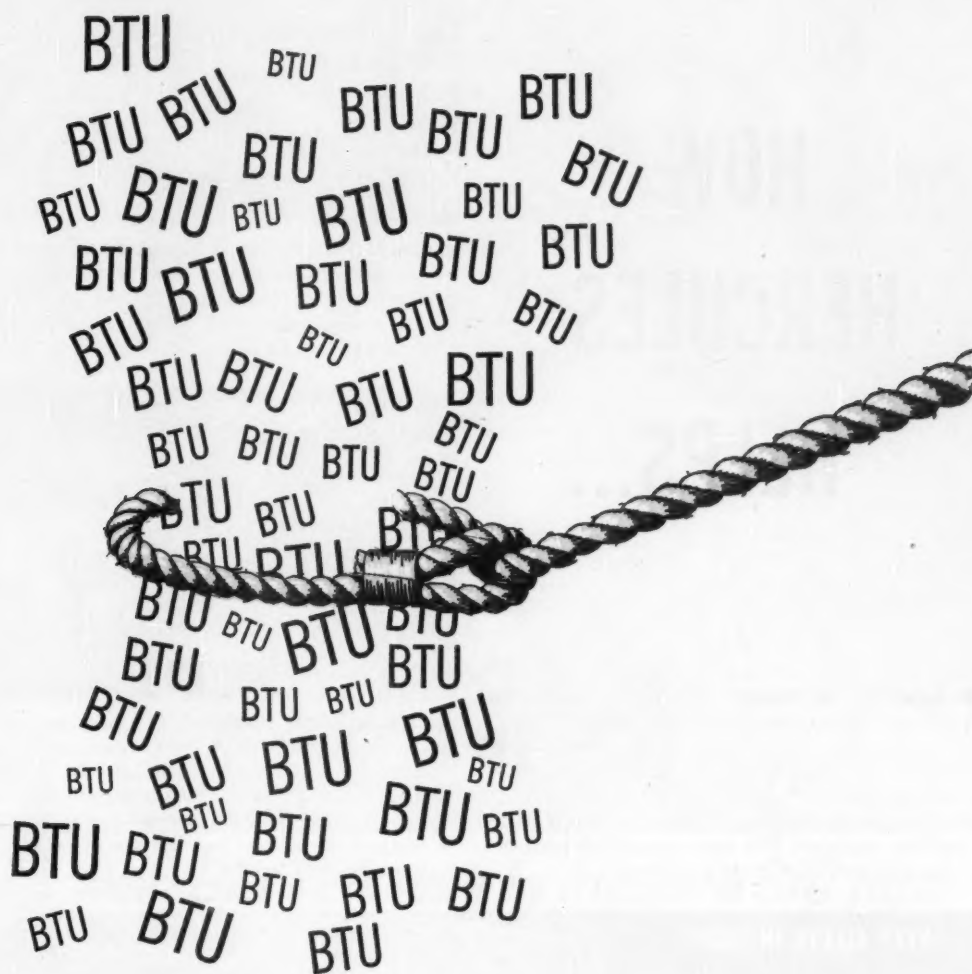
EXHAUSTING

FORCED DRAFT

COOLING

HEATING

PRESSURE BLOWING

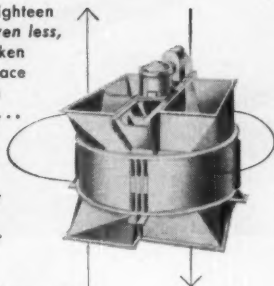


cut fuel costs

*you can save one barrel in every five with the
Ljungstrom® Air Preheater*

HOW FAST IS "WRITE OFF"?

In fuel savings alone, most refiners write off the cost of the Ljungstrom installation in twelve to eighteen months. This time is cut to *nine months and even less*, when the other Ljungstrom advantages are taken into account — permits more economical furnace design, with no need for convection surfaces . . . burns many fuels you used to throw away . . . results in consistently higher through-put . . . boosts product quality . . . and minimizes slag. For more complete details on what the Ljungstrom Air Preheater can do for you . . . for an analysis of the heat-recovery benefits attainable in fuel burning equipment — call or write The Air Preheater Corporation.



Wherever You Burn Fuel, You Need Ljungstrom

The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves, the heat is transferred from the waste gases to the incoming cold air.

How much fuel do your process units burn *just to keep the stacks hot*? It takes precious BTU's to keep them as hot as they are . . . BTU's that, if recaptured, would be working for you — instead of costing you money.

With the Ljungstrom, much waste heat is recovered from exit gases, transferred to incoming combustion air and funneled back into the furnace. How much fuel does this save? You get an idea when you consider that for every 45-50°F of preheat, your fuel bill drops 1% — and Ljungstrom Air Preheaters now in use preheat air to over 1,000°F.

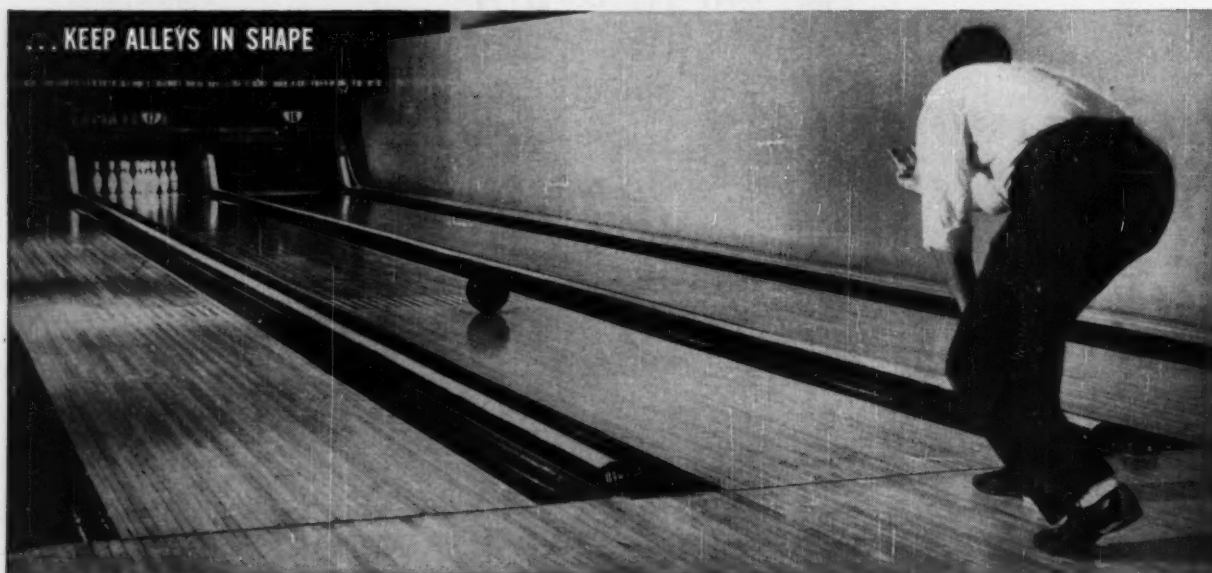
That's why a Ljungstrom saves you up to 20% of your fuel costs — *one barrel in every five*. In fact, one midwestern refiner reports \$74,200 saved in fuel in one year. And after he subtracted the Ljungstrom operating cost, he still wound up the year \$64,800 ahead.

The Air Preheater Corporation

60 East 42nd Street, New York 17, N. Y.

HOW HERCULES HELPS...

◆ **AIMING FOR THE "POCKET"**, this bowler wants the alley he uses highly polished and free of "ruts". That's why bowling alley surfaces are protected with nitrocellulose lacquer to keep them in top condition. The fastest drying protective coating known, lacquer makes it possible to put an alley back in play within hours after it has been refinished. This same tough finish protects bowling pins and other sports equipment.



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CHEMICAL MATERIALS FOR INDUSTRY

HERCULES POWDER COMPANY

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952 Market St., Wilmington 99, Del. Sales Offices in Principal Cities

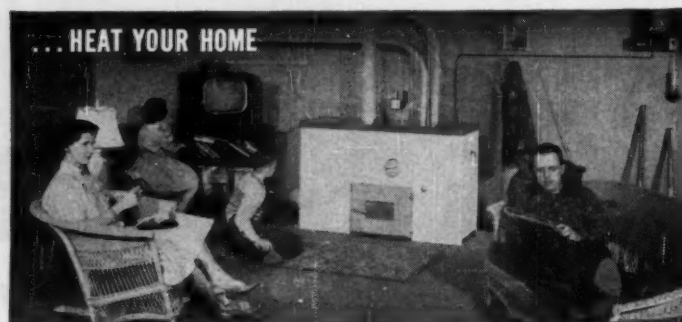
SYNTHETIC RESINS, CELLULOSE PRODUCTS, CHEMICAL COTTON, TERPENE CHEMICALS, ROSIN AND ROSIN DERIVATIVES, CHLORINATED PRODUCTS, EXPLOSIVES, AND OTHER CHEMICAL PROCESSING MATERIALS



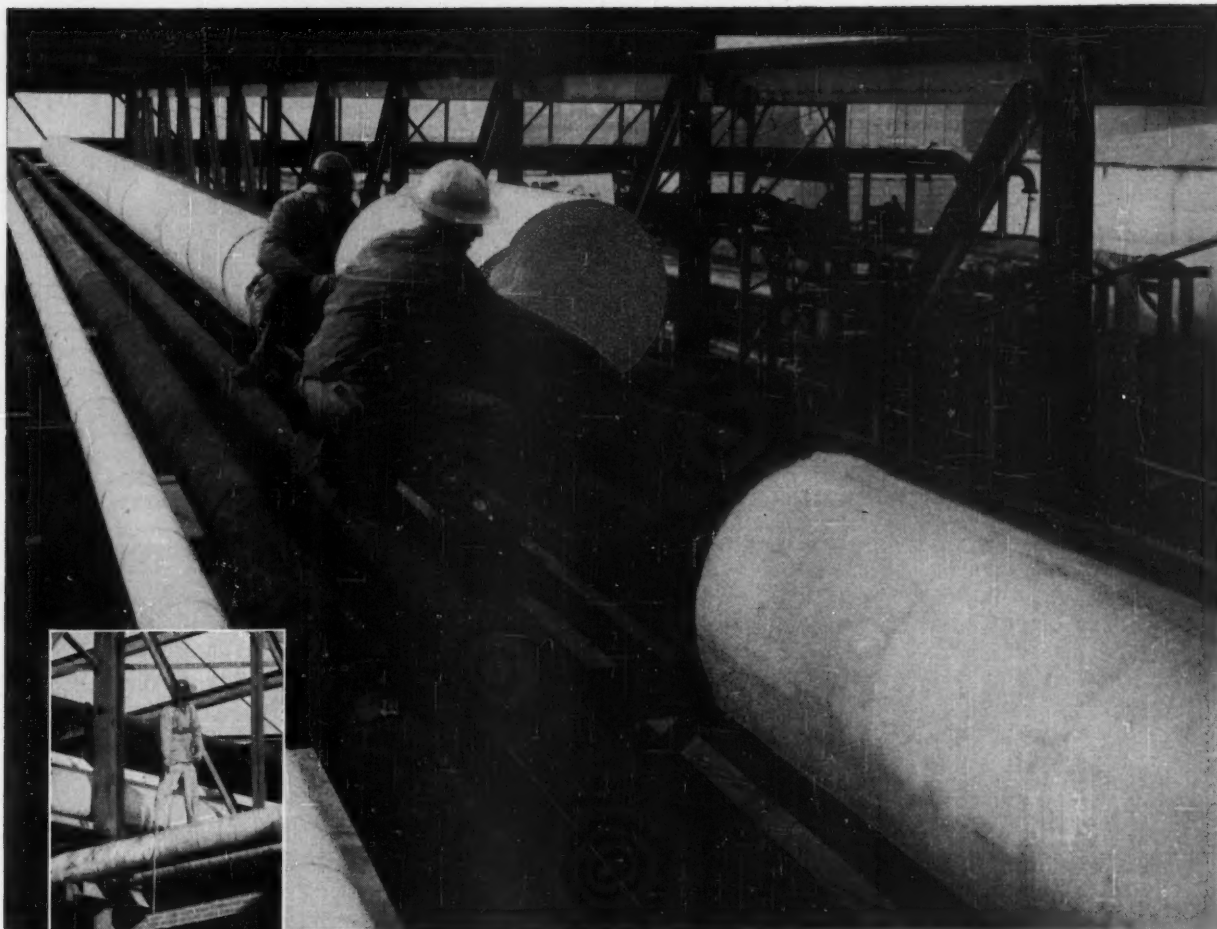
G55-4



◆ **THE BACK COUNTS, TOO**, in the manufacture of carpets. Hercules Dresinol® solvent-free resin dispersions used in conjunction with latex, starch and pigments, provide durable backings for popular-priced carpets. Dresinol furnishes either flexibility or stiffness; adds body to the carpet and improves adhesion of the backing for all types of cotton, wool and mixed fiber carpets.



◆ **NEW ANTHRACITE-BURNING BOILERS**, clean and compact, make playrooms of basements the year round; even remove ashes automatically. Mining the millions of tons of anthracite used annually for residential, commercial and industrial uses would be impossible without explosives. For more than forty years, Hercules has pioneered in blasting techniques and equipment to increase the efficient and safe use of explosives in mining, quarrying, construction, and farming.



Rugged, lightweight 6' sections are amazingly easy to handle.

New BETTER way to insulate BIG pipe

GUSTIN
gb **SNAP*ON**
BACON

Recently, more than a mile of large 250° pipe was insulated at an eastern refinery in record time and at unprecedented low cost. The key to the success of the installation was revolutionary G-B Snap*On pipe insulation—one-piece molded cylinders of fine glass fibers.

Photos tell the story. Lightweight 6' sections of 20" Snap*On, 1½" in wall thickness, were hoisted to the job by a man with a rope. Unlike segmental pipe insulation, Snap*On required no springs or special tools for application. Two men accomplished the job quickly by snapping Snap*On sections snugly around the pipe and tracer line. A weatherproof jacket was applied in accordance with standard practice for outdoor installations. There was no breakage or waste, for flexible, resilient Snap*On is tough, does not break or crumble. No clean-up time was involved because Snap*On does not flake or chip.

Next time you have chilled or heated piping to insulate, if you want maximum thermal efficiency, easier application and permanence, specify G-B Snap*On. There is **nothing** like it!

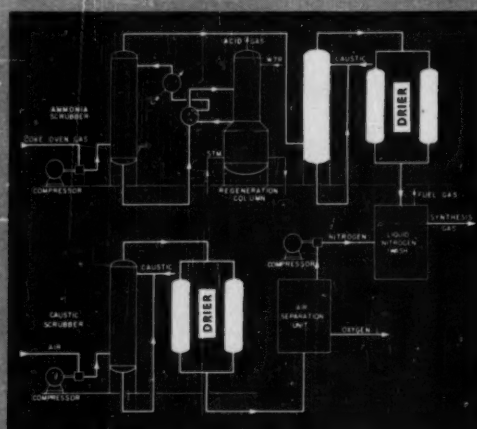
Write for 8-page brochure or see the Yellow Pages for name of your local distributor who carries local stocks of Snap*On.

GUSTIN-BACON *Manufacturing Company*

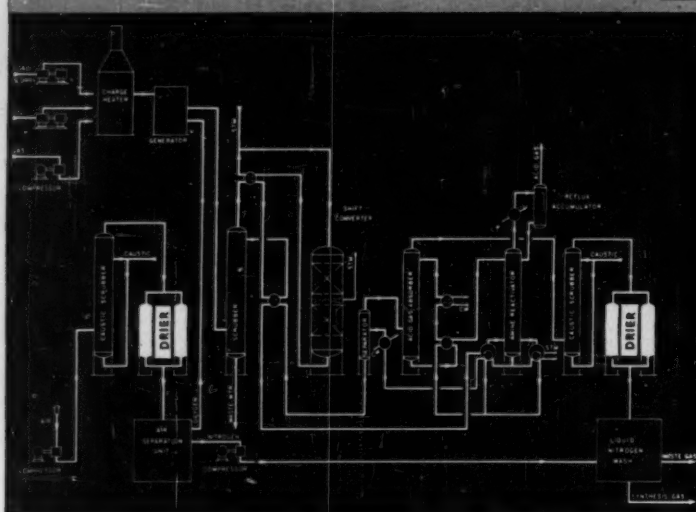
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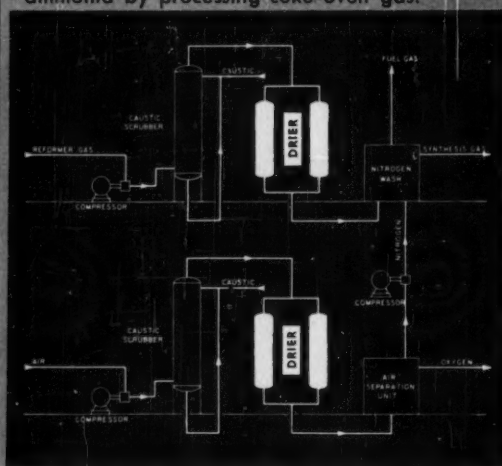
see how DRYing
functions in
synthesizing
ammonia...



▲ Typical flow scheme for synthesizing ammonia by processing coke-oven gas.



...by partial oxidation of gas, oil or coal.



...using by-product gas from a petroleum catalytic-reforming operation.

(Flow charts courtesy of The Fluor Corporation, Ltd.)

... and there's a LECTRODRYER* that meets most every size and pressure requirement

DRYing is commonplace to a process engineer. He knows that, faced with an operation requiring the DRYing of a gas, air or organic liquid, he can probably find a standard Lectrodryer proved capable of handling the job. No need to take valuable time to design and build a special drier.

Lectrodryer is the trade name for a large family of driers. They range in size from the tiny Laboratory model, for DRYing a few cubic feet per hour, to the giants on wind-tunnel work. They operate at atmos-

pheric pressures or as high as 6,000 psi. Charged with Activated Aluminas, Lectrodryers maintain their high DRYing efficiency for years, with very little attention.

Whatever your moisture problem, our engineers have likely already met one like it. They've been solving DRYing problems for years, in every kind of industry. The book, *Because Moisture Isn't Pink*, describes many of them. For a free copy, write Pittsburgh Lectrodryer Corporation, 303 32nd Street, Pittsburgh 30, Pennsylvania.

In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham.

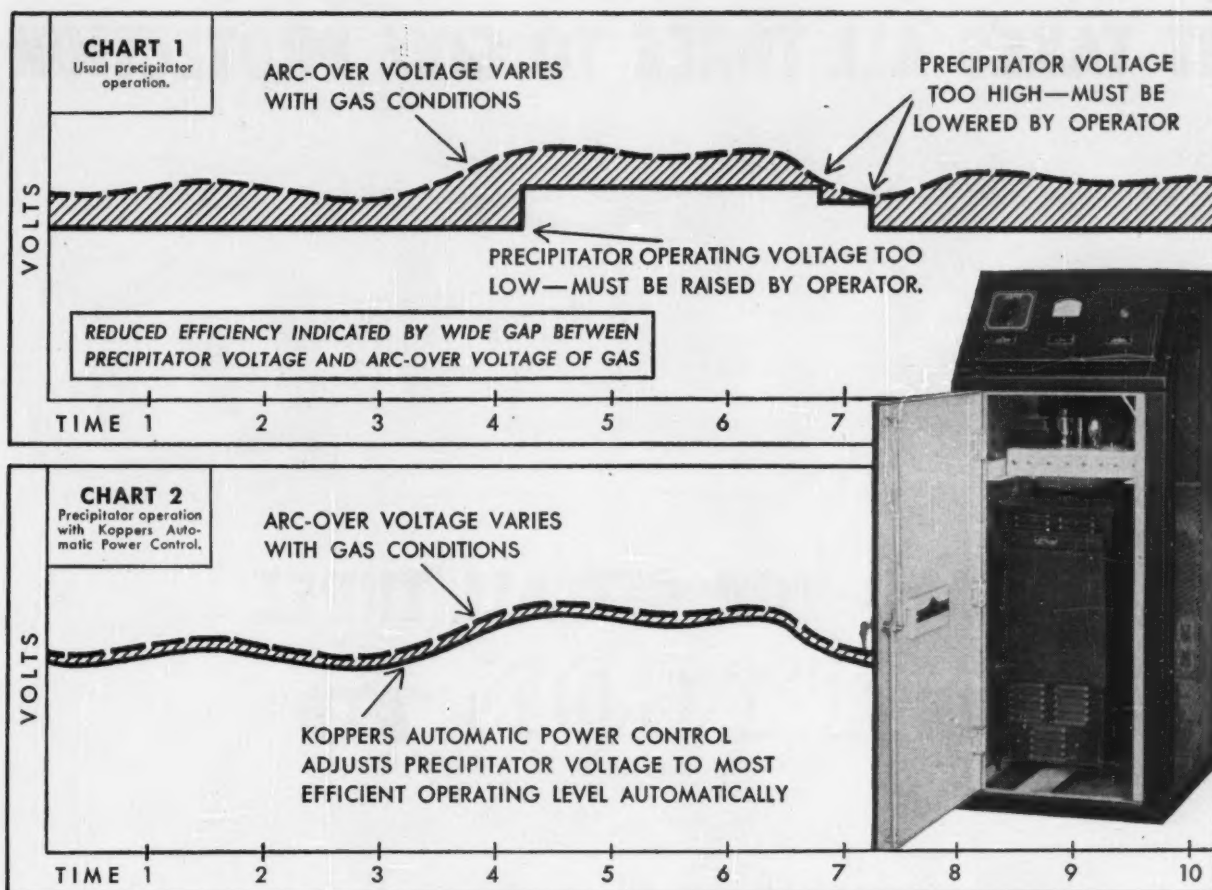
In France: Stein et Roubaix, 24 Rue Erlanger, Paris XVI.

In Belgium: S. A. Belge Stein et Roubaix, 320 Rue du Moulin, Bressoux-Liege.

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WITH ACTIVATED ALUMINAS

LECTRODRYER

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New Koppers Power Control automatically insures maximum Electrostatic Precipitator efficiency

Now Koppers enables you to get *peak* gas cleaning efficiency from your electrostatic precipitator at a minimum of operating maintenance—with the new Koppers Automatic Power Control.

This compact, cabinet unit utilizes electronic controls to automatically maintain the proper voltage to best ionize the gas. As gas conditions vary—an occurrence even under the most constant industrial operations—it automatically adjusts the voltages to the most efficient level for solids removal. This reduces wasteful "sparkover" and enables the precipitator to operate continually at peak

efficiency voltage without frequent "trip-outs."

What is more, the new Koppers Automatic Power Control eliminates the need for constant personal attendance. Completely self-contained, easy to install, it quickly repays initial cost with savings in man-hours and operating efficiency.

The new Koppers Automatic Power Control is another engineering advance in a series that has won industry-wide confidence for Koppers Electrostatic Precipitators. Keep Koppers' ability to serve *you* in mind. For information or assistance in solving your gas cleaning problem, send this coupon.



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KOPPERS COMPANY, INC., Electrostatic Precipitator Dept., 215 Scott St., Baltimore 3, Md.

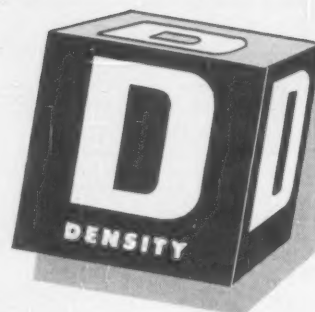
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U. S. STONEWARE

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92E

MAY 1955

Chementator

Edward T. Thompson

● Secret of Phillips' low-pressure polyethylene process is catalyzing with chrome oxides impregnated in silica-alumina gel. According to new Belgian patent, only pressure needed is to liquefy the diluent—probably isopentane—at operating temperature of about 200 F.

● New type amalgam diaphragm cell developed by Vittorio de Nora boasts current efficiency above 96%, average voltage of less than 4.3. Amalgam flows vertically along a supporting element. As with the first De Nora cell, Monsanto will be U. S. sales agent.

Poised for the petrochemical plunge

Tide Water Associated Oil may soon become a big petrochemical producer. Two projects are known to be under consideration—ethylene and ammonia.

Commercialization of either would mark a major departure for the 76-year old firm. But new management installed two years ago has united the company as it never was and is now looking for new fields. Petrochemicals seem like a natural.

Actually, some 80 million lb. a year of potential byproduct ethylene have long been burned as fuel at Tide Water's Avon, Calif., refinery. And if market possibilities now being explored firm up, a recovery unit would be installed. Beyond that, gases from the current \$20 million expansion program at Avon could account for another 80 million lb. a year.

The company gives no indication of its potential markets. But Monsanto is known to be considering another polyethylene plant to supplant its Texas City output. Since Monsanto already has phenol and acid plants at Avon (the latter operated jointly with Tide Water), a polyethylene plant there based on Tide Water ethylene would make sense. Also, Dow's Pittsburg plant and Du Pont's plant going in at Antioch—both up the Sacramento River from Avon—could be additional Tide Water ethylene buyers.

Tide Water is also conducting an ethylene market study on its \$110 million refinery under

construction in Delaware. Company vice president Harry Jackson has stated publicly that petrochemicals would be produced at the new refinery.

Though less likely to develop quickly, Tide Water is also thinking seriously of getting into the hotly competitive California ammonia market with a plant at either Avon or Chowchilla.

Will guaranteed wages hit chemicals?

Union demands for a guaranteed annual wage are still mostly limited to the auto industry. But if the United Auto Workers get a foot in the door, the repercussions will resound through the chemical process industries and elsewhere.

Chemical unions are watching Detroit carefully, while briefing their own members on what's being negotiated there. It's more of an education program than a pep talk, though. Chemical union leaders are plenty willing to let UAW set the pace for several practical reasons:

- The UAW is a strong and militant union that's pioneered in revolutionary contract demands.
- Industry-wide bargaining in autos is peculiar to only a few other industries.

These two factors are a clue to chemical union strategy. First, and most important, the chemical industry is far from organized. Even where a union exists it frequently isn't very strong and labor leaders are aware that GAW couldn't be rammed through. It would have to be piecemeal. Secondly, even breaking down one chemical maker wouldn't

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CHEMENTATOR . . .

mean it could be extended down the line. In fact, it might well increase resistance of other employers.

Seasonal output and sales of some chemicals is another important point. But chemical unions are already talking of refrigerating vaccines, storing drugs, soaps and cosmetics for a year-round market. Employers must be pressured with evidence that they can space out employment to avoid costly effects of layoffs during slack times while payrolls continue under the guaranteed wage.

Winning GAW demands union strength that the chemical unions don't have now. But they're talking of sinking \$3 million into the drive. If this pays off they'll be able to plunge into guaranteed wage demands. Until then, however, they'll have to sit on the sidelines and watch the auto workers.

Revolution in sugar?

For the first time, sugar is being successfully extracted from cane by continuous diffusion instead of convention milling and crushing techniques. If commercial operations bear out pilot plant tests on the new process, cane sugar producers are going to be able to boost yields, up purity and cut investment costs for new plants by about 50%. Labor, power and maintenance costs are cut, too.

National Cylinder Gas Co. of Chicago did the big-scale development work on the process—the first really new idea in cane processing in decades. Operating a small plant (150 tons of cane daily) at the mill of the Fellsmere Sugar Producers Assn. in Fellsmere, Fla., N.C.G. found it could extract at least 97% of the sugar in cane, compared with about 92% by milling. In addition, purity of the extract rose 2–3%.

Diffusion, which is standard procedure for beet sugar, is a very simple process and one which has been long overdue in the cane industry. A mixture of sliced cane and hot juices is charged to the bottom of the diffuser—a vertical tower within which rotates a series of helical scrolls similar to screw conveyors. Nearly boiling water flowing down the tower removes juices from the cane by both diffusion and osmosis through the cane membranes. Because the process is wholly chemical, more impurities stay in the cane when exhausted than if it had been subjected to severe crushing.

Designs are already completed for diffusion units capable of processing 150 to 1,500 tons of cane a day. National Cylinder is guaranteeing a minimum extraction of 97%, says that 99% is readily possible if desired.

And cane processing may be just the first use of this diffusion process. Other possibilities, say some observers, include oil extraction from cotton seeds and tung nuts, washing of paper pulp and pulp bleaching.

Still another fatty acid process

Catalytic hydrogenation of fatty acids to fatty alcohols is again in the news—this time an American process developed by Givaudan-Delawanna of New York. Earlier this year two European processes were made available here (detailed in *Chem. Eng.*, March 1955, p. 124); both have significant advantages over older methods, but also have drawbacks.

Now, though, using direct hydrogenation (no saponification or re-esterification) and a simple copper-containing catalyst, Givaudan feels it has licked some of the major difficulties: destruction of glycerine, loss of catalyst, some purifying problems.

An important key to the operation is the catalyst. It's made by dissolving a copper salt in the fatty acid charge stock and is recovered, essentially completely, by filtering crude alcohol product.

Hydrogenation takes place in a stainless steel, high-pressure autoclave. No glycerine is lost. And because no byproducts are formed, if you start with a pure fatty acid the alcohol formed—C₁₀ to C₂₀—can be used for some applications without further refining. Continuous operation is a distinct likelihood, too, though piloting has all been batch.

Royalty fees are described as "only a fraction of the savings that can be effected by using this method rather than competitive processes." To negotiate licenses, Givaudan has named H. L. Barnebey (835 N. Cassady, Columbus, Ohio) sole agent.

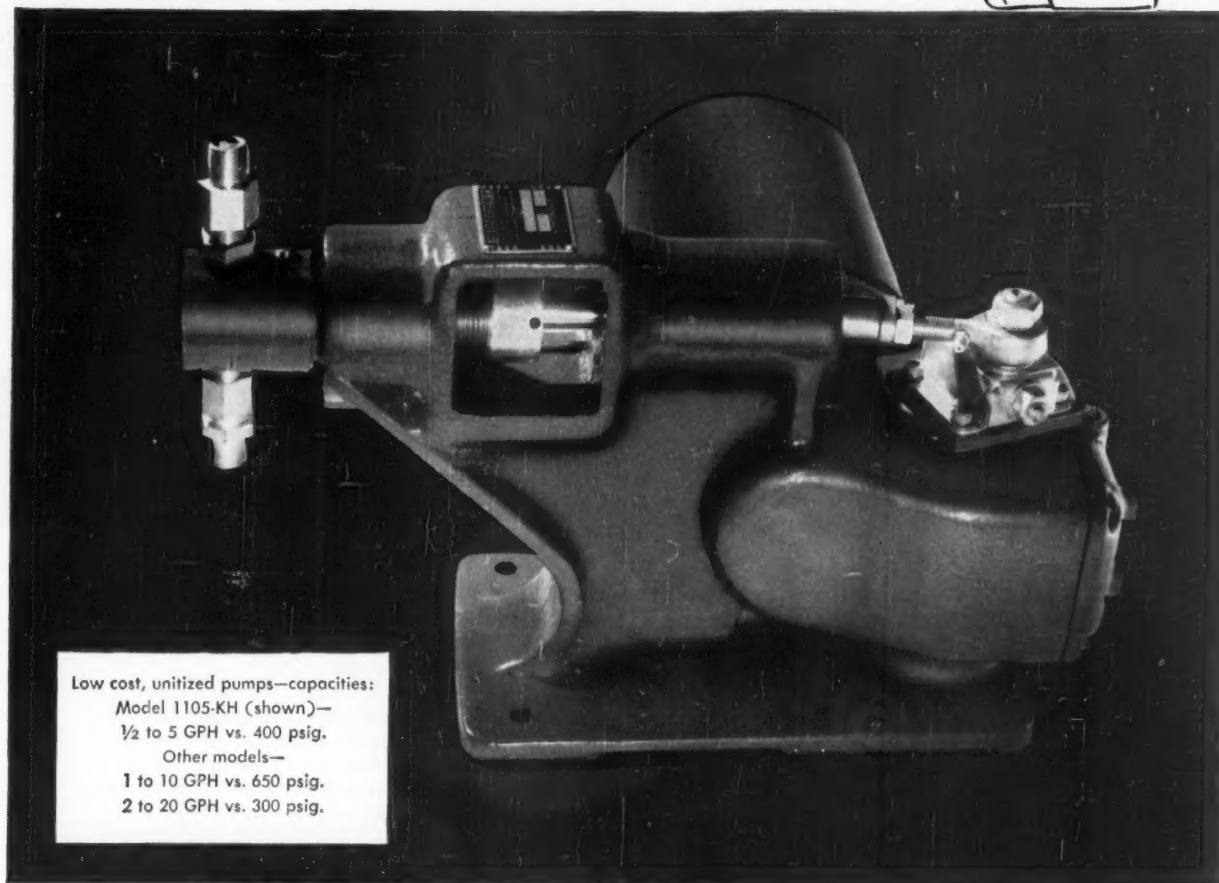
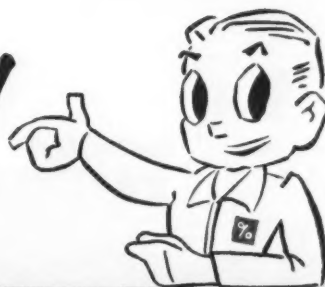
The road ahead for engineers' unions

Engineers & Scientists of America, only nationwide federation of collective bargaining units for engineers, has picked up new hope in its drive to organize U. S. nonsupervisory scientists.

ESA bases its optimism on recent surveys made by the ASCE, ASME and AIEE on the attitudes of some 64,000 member-engineers toward collective bargaining. Results show that 27% don't oppose the idea and 20% feel such action would be advantageous. ESA weeds out the engineers in supervisory or management posts and concludes that about 40% of union-eligible engineers in these societies actively favor collective bargaining.

(Continued on page 112)

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Low cost, unitized pumps—capacities:
Model 1105-KH (shown)—
1/2 to 5 GPH vs. 400 psig.
Other models—
1 to 10 GPH vs. 650 psig.
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Need it now? ...and at lowest cost? If your answer
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OLIVER Batch

Oliver Batch Pressure Filters are particularly applicable to clarification of liquids containing small amounts of solids, or for products involving volatile, inflammable or toxic materials. They are available in a number of types including units for processes that require operation to the exclusion of air to prevent oxidation or decomposition of products . . . or operation that requires filtration to take place at abnormal temperatures.

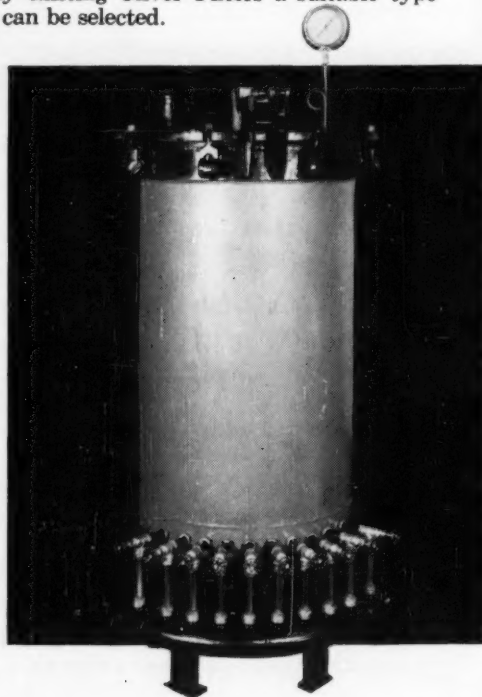
Oliver features include individual sight glass

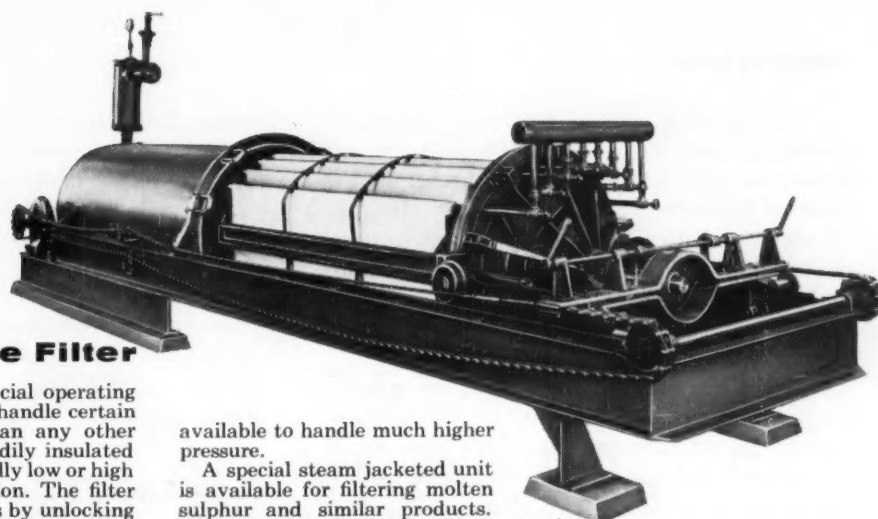
and shut off valve control for each leaf, high capacity, high washing efficiency, ease of cake discharge, low cost operation, and rugged construction which assures long life.

Dorr-Oliver engineers will be glad to place their many years of exclusive experience at your disposal for solving your filtration or clarification problems. It is probable that from one of the many existing Oliver Filters a suitable type and size can be selected.

Oliver Pressure Filter

A compact, rugged, simple to operate filter for filtering or polishing chemicals, dyes, fruit juices, syrups, wine, beer, ink and other liquids requiring clarification. It is especially designed to insure cleanliness and ease of sterilization. The ratio of filter area to filter volume has been kept at the very maximum consistent with practical filter operation. Available in three sizes with up to 100 sq. ft. of filtering area. Bulletin 123-R gives complete details. Write for your copy.





Kelly Pressure Filter

The Kelly Filter has special operating features which enable it to handle certain unique problems better than any other type of filter. It can be readily insulated or jacketed to hold abnormally low or high temperatures during filtration. The filter opens in a matter of seconds by unlocking the manifold end and rolling out the suspended filter elements for cake dumping and removal of leaves. Normal pressure is about 50 psi, but special designs are

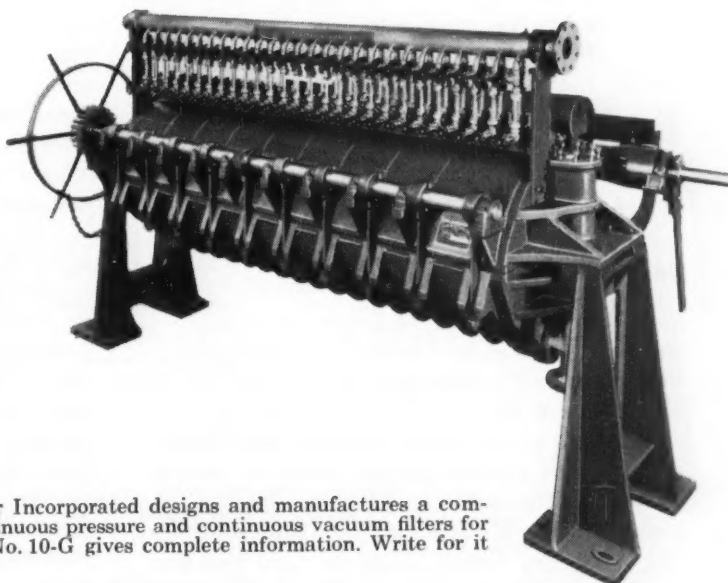
available to handle much higher pressure.

A special steam jacketed unit is available for filtering molten sulphur and similar products. The Kelly Filter is available in sizes ranging from 3 to 1300 sq. ft. of filtering area. Bulletin 113-R2 gives complete details. Write for your copy.

Pressure Filters

Sweetland Pressure Filter

The most versatile general purpose filter in the batch pressure group. Outstanding features include high filtration rate, ease of operation, variation in leaf spacing and in design of leaves which may be top or bottom drainage. Filter cake is easily discharged after lower half of shell is opened in a matter of seconds, either manually or hydraulically; or by automatic sluicing discharge without opening the filter. Several sizes available with up to 1000 sq. ft. of filtering area. Bulletin No. 114 gives complete details. Write for your copy.



For Further Information . . . Dorr-Oliver Incorporated designs and manufactures a complete line of batch pressure, continuous pressure and continuous vacuum filters for the process industries. Bulletin No. 10-G gives complete information. Write for it today.



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CHEMENTATOR . . .

Most member units of ESA are in companies employing many engineers in one location, few of whom can expect to enter management. In the chemical industry, few firms fit that picture. But for smaller groups ESA suggests that professional employees at one location form intercompany units to bargain either with individual companies or industry associations. While this hasn't caught on much yet, it's getting a lot of thought.

Meanwhile, AFL's George Meany is spurring his American Federation of Technical Employees, a group heretofore generally content to represent nonprofessionals, to step up organizing efforts among engineers and scientists. And recent speeches by Meany and other unionists indicate that a strong effort to enroll professionals in existing trade unions is on the way.

Rallying point for the opposition to unionization is the National Society of Professional Engineers. Its just published "A Professional Look at the Engineer in Industry," discusses growth and ramifications of collective bargaining and recommends a course for both management and the professional which it says will "achieve constructive results for the engineers of this country on a professional plane."

Chemical engineers, enjoying a somewhat better chance to move into management than many other types of engineers, generally haven't bought the idea of unions—yet. But they'll be subjected to increasing pressure in the future. And if today's gripes—especially on salary differentials and recognition of status—go unacted upon, the unions expect to make deep inroads.

Pfizer broadens its line

First of a whole raft of fermentation-produced chemicals set to go into commercial production in the next several months have been introduced by Chas. Pfizer & Co.

Leading off the parade—in March—was itaconic acid which is expected to find important uses in plastics, synthetic fibers, detergents and paints, among others. It's being made in volume quantities at Groton, Conn. Then in April two new esters of citric acid came out. These will be the basis of a new class of odor-free plasticizers.

Itaconic, which sells now for 60¢ a lb., was produced by Pfizer a number of years ago. But the starting material then was sugar and though the fermentation process used worked fine it just wasn't economic with such a high-cost raw material.

Now, however, Pfizer has modified its fermentation process to allow use of a "low-cost

carbohydrate"—high test, blackstrap or beet molasses. This allows volume production, which Pfizer feels will trigger many potential uses.

Itaconic is looked on as a "building block" by its fans. Two carboxy groups and a highly reactive allylic methylene group certainly make it potentially a very versatile compound. It self-polymerizes and will copolymerize with many other compounds, thus could well be an important intermediate in the preparation of many complex organic molecules.

Two reforming innovations boost octanes

Recycling low-octane non-aromatic fractions of catalytic reformer gasoline for further reforming is the latest proposed way to boost refinery yields of high-octane gasoline. Two firms have come up with similar processes to do this: Universal Oil Products with Rexforming, Houdry with Iso-Plus.

Rexforming is based on UOP's well-known Platforming process. To make 100 octane (clear) gasoline in existing units you have to raise severity to such a level for many feed stocks that yields plunge. Rexforming gets around this by stabilizing reformer gasoline made at moderate severity, then passing it through an aromatics extractor which selectively rejects the high-boiling non-aromatics that are lowest in octane. This stream is re-Platformed. High-octane aromatics and lower-boiling non-aromatics are removed with the solvent and recovered by stripping. In this way, says UOP, refiners can now get any useful octane from any reformer feed stock without sacrificing yields.

Houdry's Iso-Plus has three variations, all starting with gasoline made at moderate severity in a Houdriformer. In two of them reformer gasoline is stabilized and goes through an aromatics extractor. Low-octane fractions are sent back to the Houdriformer. Main difference between the two is in the degree of fractionation prior to extraction. The third variation stabilizes the reformer gasoline, then thermally reforms it to the desired octane; few if any aromatics are lost. All three methods give higher yields at a given octane than you can get by increasing Houdriformer severity.

Allied moves into thermoplastics

First commercial production of nylon 6—polycaprolactam—is about to begin at Allied Chemical's new plant at Chesterfield, Va. Significantly, it's Allied's first sortie into the field of thermoplastic

(Continued on page 114)

Adhesive for
boxboard, etc.

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General Chemical Sodium Silicate, with its wide range of grades and viscosities, offers you unmatched production advantages . . . because you get the product *best suited* to the particular needs of your process.

... Standard opalescent solutions range from 38° Baume to 60°. White clear solutions are available in concentrations from 38° to 52° Baume. These solutions are easily miscible with water in all proportions and may be used in highly concentrated form or as a very dilute solution. General Chemical also has Sodium Silicate available as a "glass" to be used as such or dissolved as needed.

For your general needs, General Chemical supplies mixed solutions, ready to use; no elaborate equipment is necessary. For special needs, General will prepare Sodium Silicate according to your specifications.

Sodium Silicate solutions are available in 55-gallon drums, tank cars and tank trucks. Glass is shipped in bulk. Consult our technical service staff for special grade of Sodium Silicate to meet your particular needs. Call or write today!

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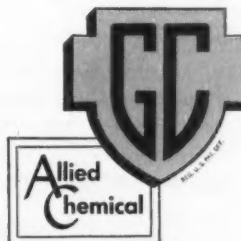
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Basic Chemicals for American Industry



CHEMENTATOR . . .

resins, except cumar resins, and, by their own admission, probably presages further growth into other thermoplastics such as polyvinyl chloride and polyethylene plastic.

Three Allied divisions combine to make this new product (called Plaskon Nylon 8200). Barrett makes phenol from benzene at Frankford, Pa. This goes to Hopewell, Va., where it's reduced to cyclohexanone with synthesis gas byproduct from the Nitrogen Div. ammonia plant. At the same time, ammonia, sulfur and air are reacted to hydroxylamine, which then leads to cyclohexanone oxime and caprolactam. Monomer is polymerized at the new Chesterfield unit, which National Aniline runs.

Out of this highly integrated operation comes nylon 6, which will be sold by Barrett. Available now only as molding powder, but soon as fiber, nylon 6 will compete in price with conventional nylon, but differs in several important properties.

For example, molten viscosity is higher, eliminating leakage from nozzles and joints during molding and extrusion. Also, crystalline structure is controlled: At low mold temperatures you get maximum toughness with minimum shrinkage; as temperature rises, the material becomes more rigid; but even at 200 F. it's not brittle. Nor does this nylon decompose or liberate gas during molding. This permits thick pieces to be made with a minimum of voids.

Products molded from nylon 6 have great strength, impact and abrasion resistance and toughness, says Allied. Also, they can be cold colored to a few millimeters depth. (For fully colored pieces, blending before molding can be used.)

Allied is bullish about the future of nylon molding material. Though it is high-priced, versatility and extremely high strength allow it to compete with cheaper materials on an actual cost basis.

Northwest power in trouble again

Low stream flow and unseasonable power demands have caused Bonneville Power Administration to cut its interruptible energy deliveries to 14 Northwest industrial plants by 75% for an indefinite period.* Even the last 25% may be cut before the crisis ends.

Prolonged cold weather this year held power demand in the Pacific Northwest at a high level—just 267,000 kw. under peak winter demand. Normally, demand drops 500,000 kw. below the winter peak by mid-March. And complicating the

situation, some 700,000 kw. of peak load potential was lost because of a drop in stream flows.

Ten of the 14 plants are making up the lost energy by importing power from Canada or by using available steam power. But they're paying about three times as much as they do for interruptible energy from the federal system. On the basis of energy available, says BPA, it would cost the 14 plants \$15,000 a day to make up all the power that was slashed.

Fortunately, there's no worry about BPA's ability to supply all firm power commitments even under critical stream flow conditions. And the interruptible situation should improve soon because there's strong indication that all federal storage reservoirs will fill during the spring runoff.

Salt cake: New supply for a tight market

West End Chemical Co. will soon bolster inadequate U. S. supplies of salt cake with production from a \$1.2 million, 150-ton-per-day plant at Searles Lake, Calif. First unit to tap the 750 tons per day of sodium sulfate long available in brine processed by West End for borax and soda ash, the plant is scheduled for shake-down in mid-May. Bulk shipments are due to start July 1.

And if the new West End-developed process fulfills its promise and demand stays high, a second 150-ton-per-day unit will go up next year.

West End's Searles operations are unique in that they entail no brine evaporation. Carbonation gives soda ash, chilling and seeding produces borax. And now, further chilling in a triple-effect refrigeration cycle will produce salt cake.

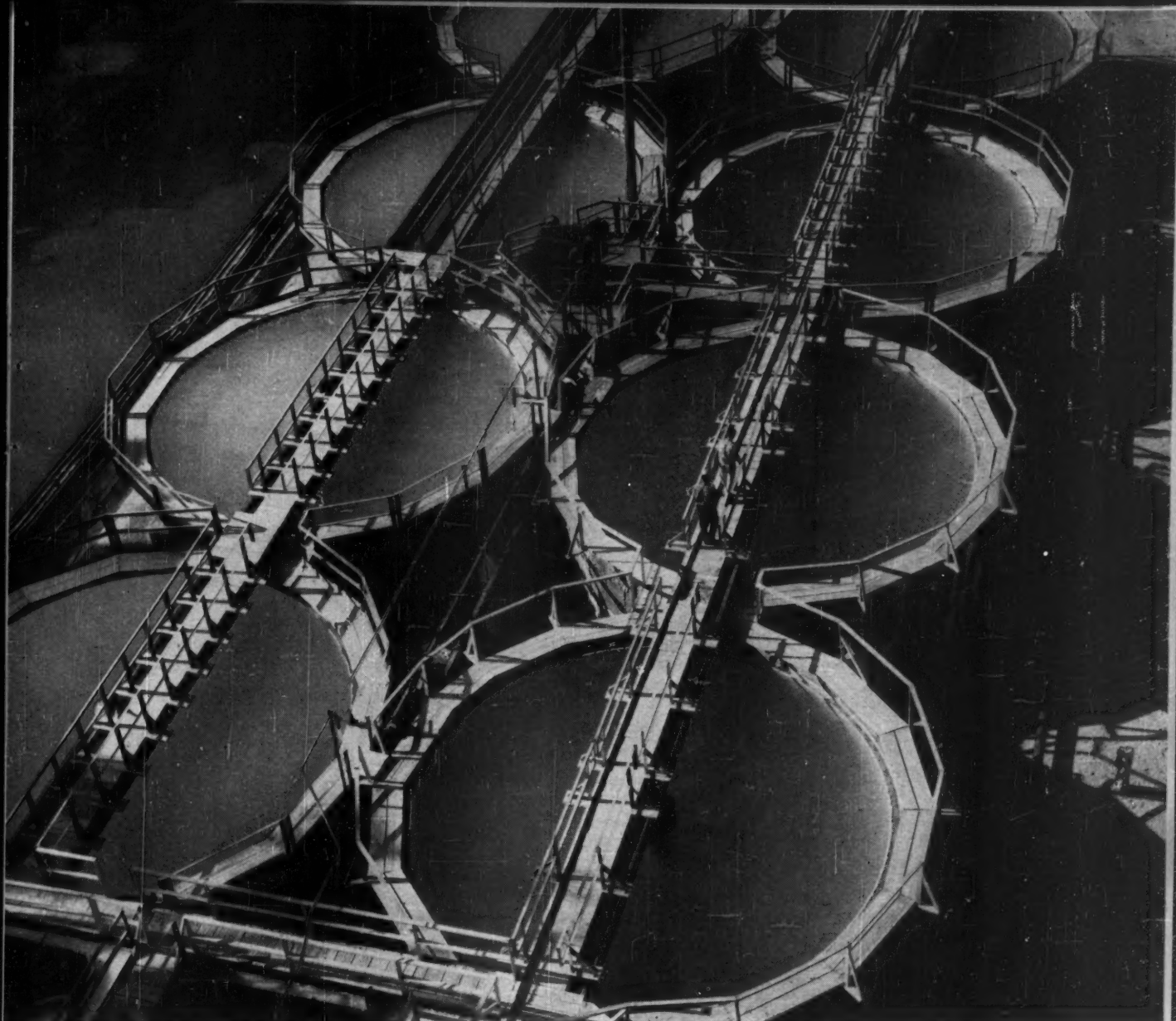
Brine from the borax plant will enter ammonia refrigeration at 60 F., leave at 45 F. Sodium sulfate decahydrate crystals thus formed will settle out in a hydro separator. After classification in a Dorr classifier, the decahydrate will be fed to a special evaporator, where it will be converted to the anhydrous form.

This evaporator is the heart of the process. It and the process are covered in U. S. patents 2,640,761 and 2,640,762 issued nearly two years ago.

Since sodium sulfate has an inverse solubility curve, salting up of equipment has always been a major problem. West End solves this by carrying out evaporation entirely in a liquid medium. Brine is fed at several levels under pressure. Heat from the fire box at the top is transferred to the sulfate solution through the walls of a stainless steel core. Anhydrous slurry is then dried and air-separated.

For more of WHAT'S HAPPENING 116

* Suffering companies are Alcoa, Kaiser Aluminum, Reynolds Metals, Electro-Metallurgical, PennSalt, Keokuk Electro-Metals, Pacific Northwest Alloys, Rayonier, Crown Zellerbach and Victor Chemical.



Mathieson Caustic Soda: *why settle for less?*

In the lime-soda process—one of the two important methods of making caustic soda—the causticizing operation begins in huge settling tanks like those above. Here, a soda ash solution is treated with milk of lime, calcium carbonate is precipitated and a dilute caustic liquor obtained. This liquid is then filtered and concentrated to the commercial 50% and 73% solutions, as well as to the solid, flake, and granular forms. Lime-soda process caustic is produced at Lake Charles, La., and Saltville, Va.; four other strategically located plants produce electrolytic process caustic to make Mathieson a major source of this essential chemical raw material.

Multiple-process and multiple-plant facilities give Mathieson's caustic soda customers the dependability they want. It means their source of caustic is not controlled by

seasonal fluctuations in chlorine demand as is sometimes the case when production is limited to the electrolytic caustic-chlorine process. This operational flexibility is also typical of other Mathieson chemicals—5 chlorine plants, 7 sulphuric acid plants, 3 alkali plants, 3 ammonia plants, provide a safety factor that assures a reliable source of chemical raw materials.

Call on us when planning current or future chemical requirements. Perhaps you can buy to better advantage from one of America's largest producers of basic industrial chemicals.

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MAY
1955

What's Happening

Five New Polyethylene Units

With a swoosh, America has added nearly 225 million lb. a year of polyethylene capacity.

Like a relay race, no sooner does one new polyethylene plant start running than another pops up all ready to go. In just a few recent weeks four more companies revealed that their new installations are operating at or near capacity. And a fifth is rapidly nearing completion. By the end of this year U.S. capacity will exceed 515 million lb. a year.

Carbide at Seadrift

First of the current group to start up was Carbide and Carbon Chemicals Co. at Seadrift, Tex. This new plant, which turned out its initial polyethylene last September, is now fully on stream and is making regular bulk shipments (specification grade) of all products—ethylene oxide, polyethylene and butadiene.

Rated polyethylene capacity is 60 million lb. annually, more than the entire industry produced in 1950. Seadrift is Carbide's third such plant. A fourth, also with a capacity of 60 million lb., is scheduled to go into operation at Torrance, Calif., early next year. The other two Carbide plants are at S. Charleston, W. Va. (70 million lb.) and Texas City, Tex. (60 million lb.).

Spencer at Orange

Just 15 minutes after start-up in February, Spencer Chemical's new PE plant at Orange, Tex., went

onto automatic controls. And it's run that way ever since. Like all the other new U.S. plants, this 45-million-lb.-per-year unit uses the basic high-pressure process developed by Imperial Chemical Industries of England.

Spencer is particularly happy about the cost of its new plant, too. In its report for the quarter ending Dec. 31, 1954, the company stated: "Indications are that the completed cost of the plant will be substantially less than the \$14 million originally estimated." Part of this is attributed to design modifications.

Monsanto at Texas City

Another newcomer to the polyethylene market place is Monsanto Chemical Co., which just brought in a 60-million-lb.-per-year plant at Texas City, Tex. And unlike some, Monsanto doesn't seem to be very worried about possible oversupply of the product during the next few years.

Says E. S. Childs, sales manager for polyethylene: "Present markets for the material have yet to be fully satisfied. Keen competition that is in evidence already will force resin, machinery and production efficiency development programs into high gear. The next 2 or 3 years of polyethylene's growth should witness more advances than have taken place during its previous 15-year history."

Monsanto also says that it's re-

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searching a low-pressure polymerization process expected to produce a high-melting polyethylene that should open up important new application areas. Most likely this is the Ziegler process on which several U. S. firms have taken out expensive investigative licenses recently (see *Chem. Eng.*, April 1955, p. 103).

National Pet at Tuscola

Latest to go on stream is National Petro-Chemicals' plant at Tuscola, Ill. Present capacity is 26 million lb. annually, but provisions have been made for quick expansion if it's warranted. National Pet's product, tradenamed Petrothene, is being sold in pellet form.

Dow at Freeport

Now getting its finishing touches is Dow Chemical Co.'s 25-million-lb.-per-year polyethylene plant at Freeport, Tex. Already, test samples are being supplied. Capacity production is expected to begin in a very few weeks.

in Chemical Engineering



REYNOLDS' new Robert P. Patterson reduction plant at Arkadelphia, Ark., leads the way as . . .

Big Cells Cut Aluminum Costs

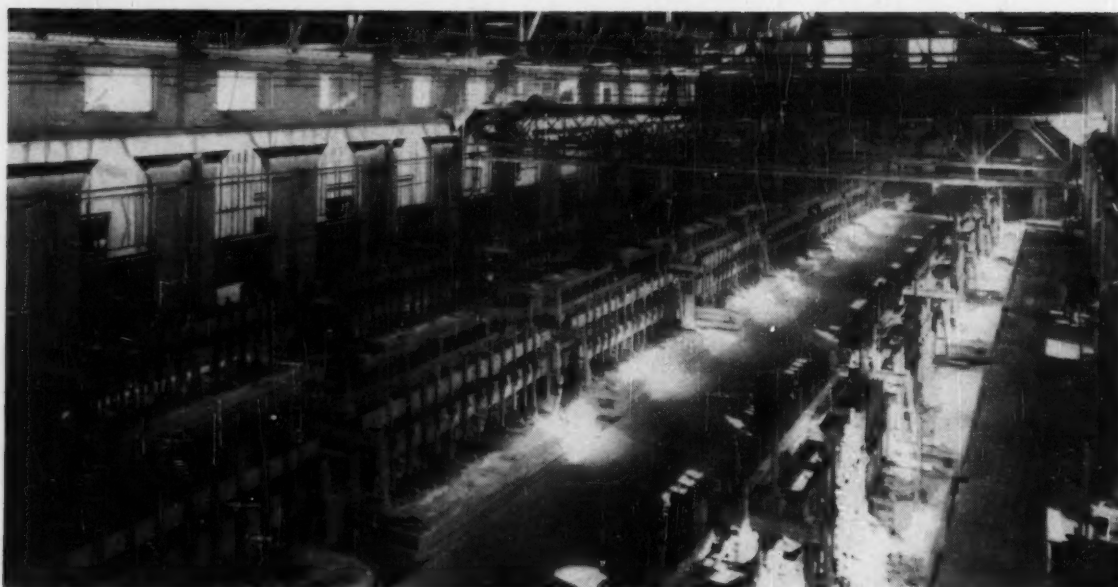
Larger units, drawing 100,000 amperes or more, consume less power per pound of metal, use less labor, save on capital investment.

Largest electrolytic cells ever operated for commercial production of aluminum are being used by Reynolds Metals Co. in its two newest reduction plants.

Each of the 400 giant cells—

240 at Corpus Christi, Tex., and 160 at Arkadelphia, Ark.—produces 2,000 lb. of aluminum daily. This is approximately twice the production rate of the next largest cells now in use in the U.S.

Reynolds hasn't revealed the exact amperage being used nor the cell's unit power consumption. Theoretical minimum current to make 1 lb. per day of aluminum is 56.5 amp. So with a reasonable



PECHINEY pioneered the 100,000-amp. cell at its plant at Saint Jean de Maurienne, France.

current efficiency of 84%, the new cell would have to operate at about 135,000 amp. to produce metal at the rate of 2,000 lb. per day.

And if we take Reynolds' figure on power supply at Arkadelphia (100,000 kw.), divide it by the hourly output of 160 cells, we come up with a probable unit power consumption of 7.5 kwh. per lb.—an improvement over the reported industry-wide average of 8.5 kwh. **►More Big Cells**—Although Reynolds no doubt has the biggest cells in operation, the company is not the only one seeking the advantages of larger reduction units:

- Pechiney, leading French producer, pioneered a 100,000-amp. cell immediately following World War II, has been operating units of this size commercially for several years. In 1953 Pechiney's average power consumption for eight plants—including older 35,000, 45,000 and 55,000-amp. cells as well as the big ones—averaged 8.11 kwh. per lb. This checks with reports brought back by American visitors to Pechiney's operations that power consumption for the big cell is 7.5 kwh. per lb.

- Anaconda Aluminum Co. will use 100,000-amp. cells, based on Pechiney designs, in its new plant being built at Columbia Falls, Mont.

- Aluminum Co. of America, while declining to comment on its present interest in big cells, has also bought Pechiney designs.

- Aluminum Co. of Canada has 346 100,000-amp. cells in its new Kitimat, B. C., plant.

- Kaiser Aluminum & Chemical Co., whose largest cells to date are 64,500 amp., is considering construction of 100,000-amp. prototype cells for evaluation work.

- **Self-Baking Anode**—All the large cells use Soderberg self-baking anodes, made under patents held by and licensed from Elektrokemisk A/S, Oslo, Norway.

The Soderberg anode seems to be essential to the success of the big cells. One of the early installations of 100,000-amp. cells in Europe used prebaked anodes, but it was abandoned.

The first cell in the 100,000-amp. range to be run in the U. S. was installed in 1947 as a test unit, drawing current from a number of smaller lines. Designed by Elektrokemisk, it was the first Soderberg installation of this size in the world, double the size of then-existing units.

Elektrokemisk declines to identify the aluminum producer involved in this early test.

- **Power Savings**—Big selling point of the large aluminum cell is its

lower power consumption per unit of output.

Theoretical energy required to electrolyze alumina is only 3.5 kwh. per lb. Much of the excess power goes into heat losses (the cell operates at over 1,700 F.). Larger cells can conserve this heat better than smaller ones, accounting for a good bit of their power economy.

Another advantage of big cells is easier control. Fluctuations in feed rate and electrode spacing are not so critical. This improved control is also reflected in more efficient power use.

Other obvious attractions are lower first cost and labor requirements. Investment is less not only in the cellroom itself—fewer cells, less floor space, easier fume control—but since less power is consumed, investment in costly power supply and rectification facilities is less.

Cell-tapping labor, of course, is cut by less frequent tapping per lb. of production because of the larger reservoir of molten aluminum contained in the larger cell. Reynolds has also cut down on cell-feeding labor with the development of a mechanical "pot puncher." This is an air-operated, paving-breaker type of device mounted on a mobile truck (see cut, next page). It's used

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Heavy Metals (as Pb).....	0.001%
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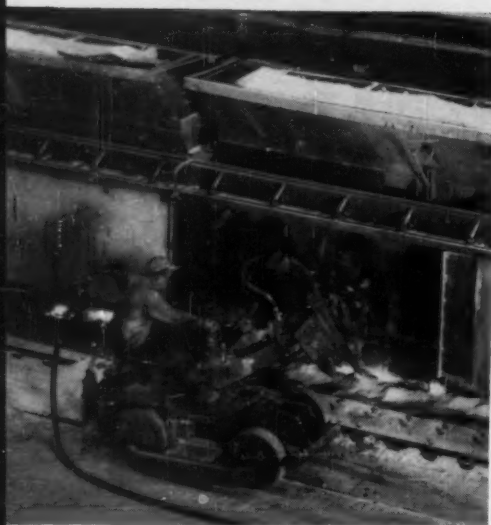
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WHAT'S HAPPENING . . .



FEEDING labor is less with Reynolds' truck-mounted crust breaker.



CONTROL of electrode position is not as critical with larger cells.

to break the crust on top of the bath so that alumina can flow from the feed hoppers into the cell.

► **Physical Dimensions**—The Reynolds cell is approximately 12 ft. wide by 38 ft. long. It is 3 ft. deep below floor level (which is about the same as the level of the electrolyte). The cell structure above floor level visible in the illustrations consists of the feed hoppers and the prebaking zone for the 5-ft. by 33-ft. Soderberg electrode.

Alcan's Kitimat cells are 11 ft. wide, 32 ft. long and 3½ ft. deep.

Kaiser's Chalmette (La.) cells, which operate at 64,500 amp. to make nearly 1,000 lb. per day each, are 10 ft. wide and 19½ ft. long.

► **Future Prospects**—Bigger cells aren't necessarily the answer to lower cost aluminum. Any way of reducing voltage drop across the cell would improve power efficiency. And with so much carbon in the cathode to be replaced if anything goes wrong, big cells represent a bit of a gamble.

Replacement of the carbon lining (cathode) is a part of regular plant operation. It is important to get the highest possible output between relinings, and this importance increases with the size of the cell.

At the same time it is more difficult to design a durable lining for a large cell than for a small one. According to Elektrokemisk engineers, chief obstacle holding back the development of still bigger reduction cells is the cathode problem.

But the aluminum industry, faced with rising power and material costs, must continue to improve its operating efficiency if it is to maintain its rapid growth rate (see *Chem. Eng.*, April 1955, p. 268).

This country has about reached its limit of cheap hydro power available in large blocks. Cheap natural gas, which supports the aluminum industry in the Southwest, is also getting harder to come by. Even now, aluminum made from gas-derived power costs as much as 2¢ per lb. more than metal made from hydro power.

Power based on lignite (e.g., Alcoa's Rockdale, Tex., plant) will not reach its potentially low cost until the byproduct lignite tar can be sold for its chemical value. This hope has yet to be realized.

Looking into the aluminum future, the Paley report in 1952 predicted: "Developments are expected to lead to totally enclosed, single-electrode refining cells and reduce the power requirements per pound of metal to 6.4 to 6.8 kwh." Reynolds, Pechiney and others are already well on their way to reaching this goal.

Canada to Get Fluid Cracking Catalyst Unit

Completely dependent now on U. S. sources of catalyst for fluid cracking of petroleum, Canada will soon have a plant of its own big enough to supply all its needs for the foreseeable future. To be built by Davison Chemical Co., a division of W. R. Grace & Co., the \$6 million installation will be located on a 30-acre site at Valleyfield, Que., near Montreal.

Product from the new plant will be similar to that made by Davison at its U. S. locations. All raw materials—sodium silicate solution, sulfuric acid, ammonia and hydrated alumina—will come from Canada, necessitating erection—by some other firm—of a sodium silicate plant, probably adjacent to the Davison plant.

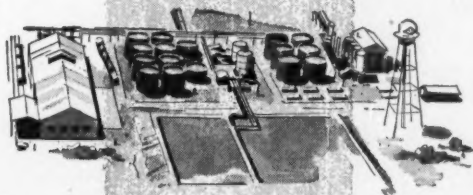
Standard Pumps Needed By Chemical Industry

A new plan proposed by the American Standards Assn. to standardize centrifugal pumps is estimated to be capable of saving the chemical industry \$6.8 million a year. The proposal deals specifically with low-pressure centrifugal pumps—classified as horizontal, end-suction, single-stage and electric driven—ranging from 5 to 1,000 gpm. at temperatures to 500 F.

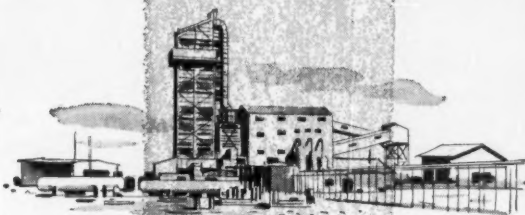
Commercially available pumps often differ slightly in dimensions for no apparent functional reason. Standardization would give:

- Lower replacement costs due to interchangeability of parts, lower capital investment due to reduced design time, and decreased maintenance costs.
- Savings to pump makers through uniform specification and elimination of many special features.
- Lower manpower requirements and lower consumption of essential materials.

Because the chemical industry has prime interest in this project, the Manufacturing Chemists Assn. has been asked to assume administrative leadership of the program.



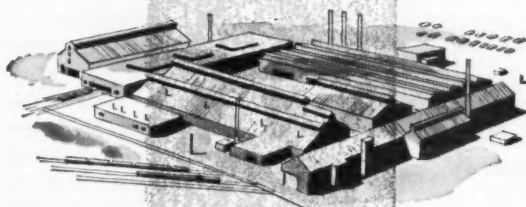
PETRO-CHEMICAL PLANT in Texas to produce ethylene from natural gas by the owner's process.



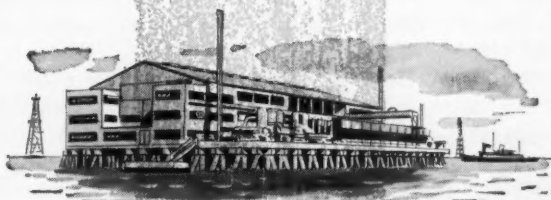
ORGANIC CHEMICAL PLANT to produce insecticides—DDT and BHC—located in the State of Alabama.



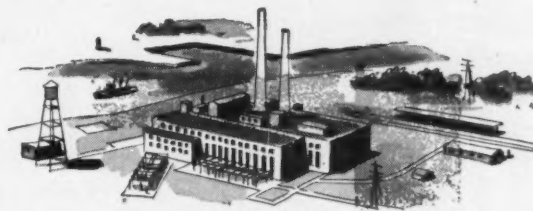
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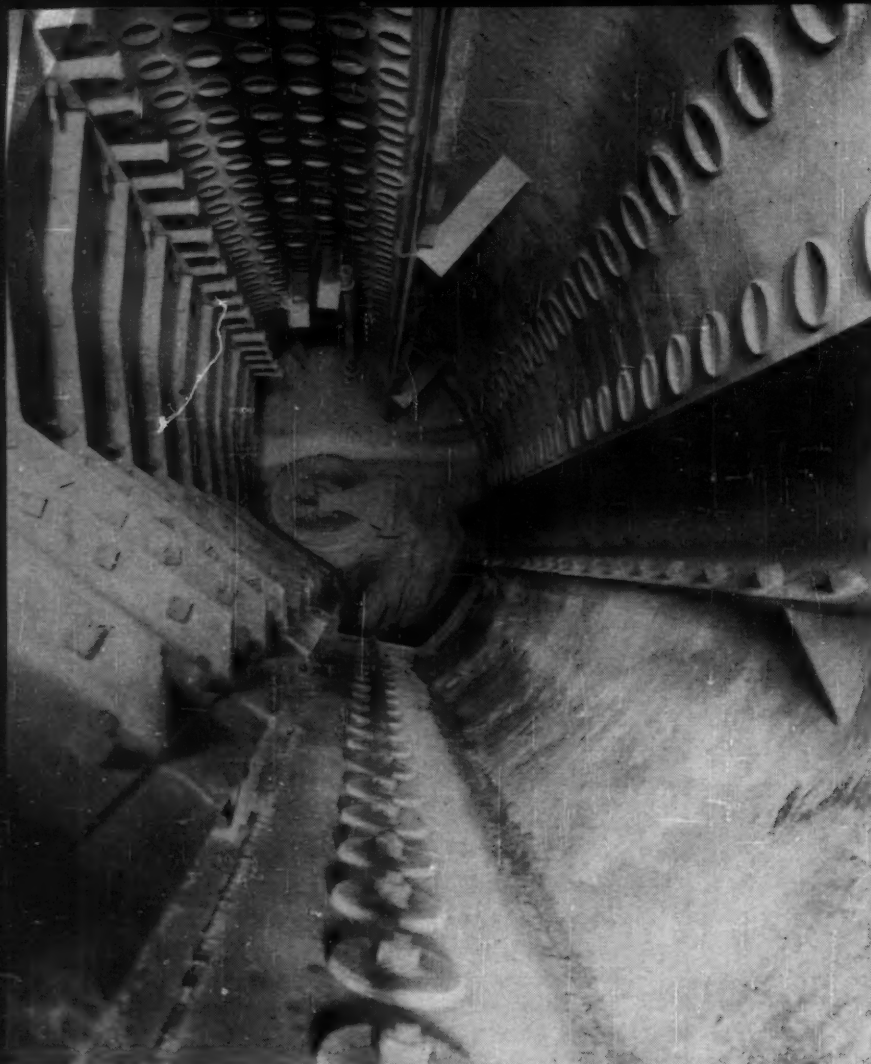
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CLEAN BOILER after 3,500 hr. service is Olin Mathieson's reward as . . .

Hydrazine Treats Feedwater

At one-sixth its 1949 price, drawn by the challenge of higher boiler pressures, hydrazine starts chipping at the huge feedwater chemicals market.

Written a year ago, this story would have had to tag hydrazine's role in boiler feedwater deoxygenation as embryonic. Today we can safely say that this end use, warmed by an increasingly favorable environment, has hatched from the egg and seems headed for a lusty growth.

In early 1954 only eight steam stations were using hydrazine—a foothold that took three years to develop. This month Olin Mathieson, top producer of the chemical,

reports more than 20 utility installations in which hydrazine is scavenging oxygen from boiler feedwater. Add to this total four Olin Mathieson chemical plants whose steam-generating units have recently gone over to hydrazine, and you have the picture of a momentum-gaining year.

Admittedly twenty-odd plants—or even 200—represent only a small part of the vast network of steam stations serving both home and industry. But it's a respectable stake

for a material which five years ago was scarcely considered a boiler-water chemical.

► **The Reasons Why**—Two trends have paved the way for hydrazine's acceptance:

- Boiler pressures have mounted sharply—central station practice now flirts with pressures of 2,500 psi. and more—and the need for chemicals to augment mechanical deaeration has intensified. Sodium sulfite, the long-accepted deoxygenating chemical, has not always been equal to demands imposed by pressures above 900 psi.

- Hydrazine's price came down out of the clouds. In 1949 it sold for \$9 per lb.; in 1953, \$2.50; today, about \$1.50. Olin Mathieson expects, ultimately, to chop that figure in half.

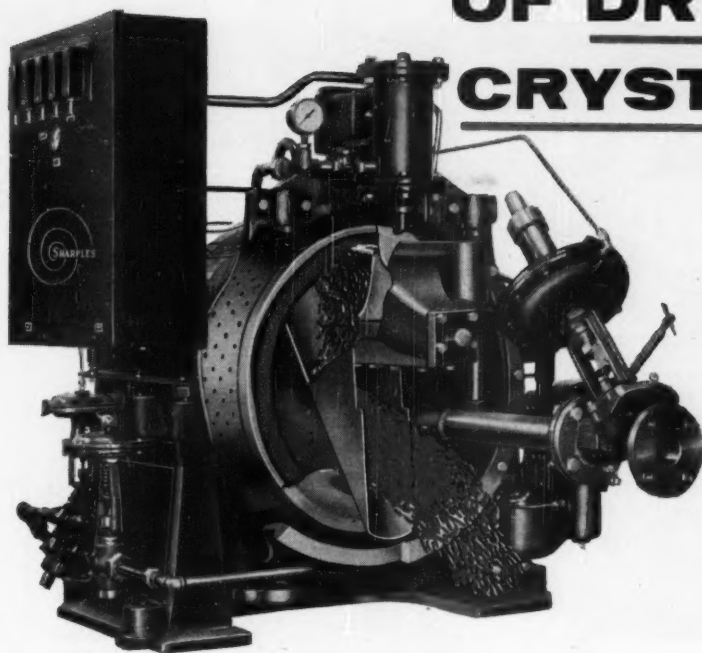
With its price skidding to the \$1 to \$2 per lb. range, hydrazine's high deoxygenating efficiency—one pound of hydrazine hydrate is equivalent to 20-30 lb. of sodium sulfite—is able to rub out sodium sulfite's remaining price advantage (sulfite costs about 11¢ per lb.). No longer a high-cost chemical for feedwater treatment, hydrazine was thus given a chance to tackle the newer problems of high-pressure steam systems.

Hydrazine's performance to date points up two advantages not possessed by sodium sulfite and other reducing agents:

- Hydrazine is more stable than sodium sulfite at high temperatures. And even if it should break down, it will not, like the sulfite, liberate corrosive acid products. Hydrazine, in fact, partially decomposes to form ammonia, thus tends to help maintain, if properly controlled, an alkaline pH throughout the system that represses corrosion due to dissolved carbon dioxide.

- Hydrazine adds no solids to the boiler water; it reacts with oxygen to form nitrogen and water and a trace of ammonia. Solids in a steam cycle can mean trouble, especially if water containing them enters the system after the boiler, i.e., desuperheating to control final steam temperature (solids may plug

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WHAT'S HAPPENING . . .

desuperheater apertures, erode turbine blades).

► **Switch to Low**—With hydrazine proving itself at high pressure. Olin Mathieson wondered whether it would also show dividends in lower pressure boilers (less than 900 psi.), the kind that provide industrial plants with power and process steam.

To find out, the company is putting hydrazine to work in the four plants mentioned,* at pressures of 150 to 650 psi. For there's no surer way to demonstrate a product's utility—and thereby woo a market—than to use it successfully in one's front yard.

Reports are in from the first unit to use hydrazine, the Doe Run plant at Brandenburg, Ky., whose three 650-psi. boilers generate 5 million lb. of 750 F. steam daily. Corrosion and oxide pitting of boiler equipment are negligible after more than 3,500 hr. continuous service with hydrazine-treated feedwater.

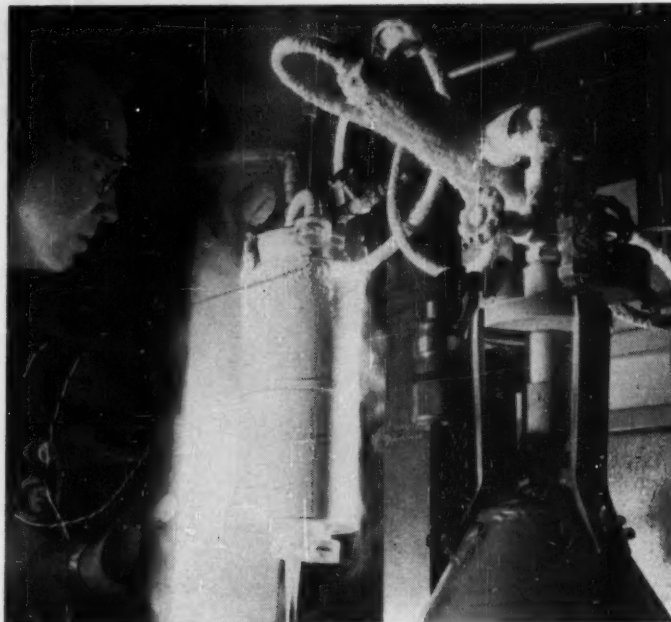
The hoped-for edges over sodium sulfite are manifest, too. Boilers run cleaner, afford better heat transfer; storage and handling are simpler.

► **Cleaner**—Only a small amount of soft powder collected on—and was easily brushed from—the interior surfaces of the boilers. When sodium sulfite was used for water treatment exposed surfaces of the steam drums were coated with a white film and the tubes with a hard scale. Both deposits cut down heat transfer, were difficult to remove.

► **Easier**—Doe Run's steam plant treats, on an average, 4,580,000 lb. of feedwater (including 40-60% makeup) in a 24-hr. day. To deoxygenate this volume requires but $\frac{3}{4}$ lb.† of hydrazine hydrate (54.4% active N_2H_4). Put another way, a 240-lb. drum of hydrazine hydrate (a liquid) will last for 21 months at Doe Run; to do the same job with sulfite entails storing and handling 6,400 lb. of a solid chemical.

*Brandenburg, Ky., Niagara Falls, N. Y., Morgantown, W. Va., and Lake Charles, La.

†A hydrazine addition rate in the boiler feedwater of well under 0.1 ppm. maintains oxygen-free water in the system.



Test Metals Near Absolute Zero

Metallurgists at Westinghouse Electric Corp. can now conduct tensile strength tests on metals down to -452 F. They use a specially designed chamber (above) that's cooled first with liquid nitrogen (to -320 F.), then with liquid helium.

Aims are to gain better understanding of the factors that cause embrittlement failures, and to provide basic engineering data needed to develop such equipment as low-temperature liquid fuel and coolant tanks for guided missiles.

Two More New Ammonia Plants Set

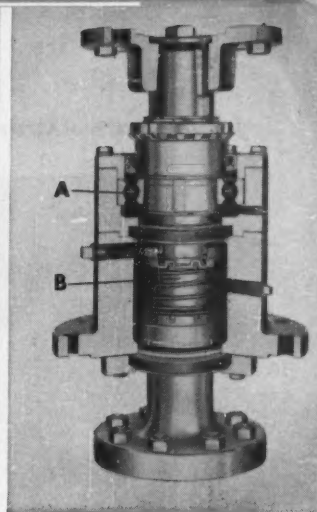
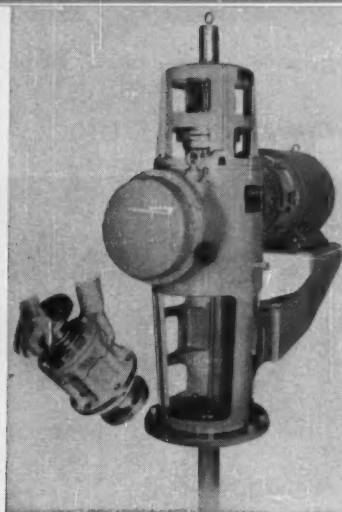
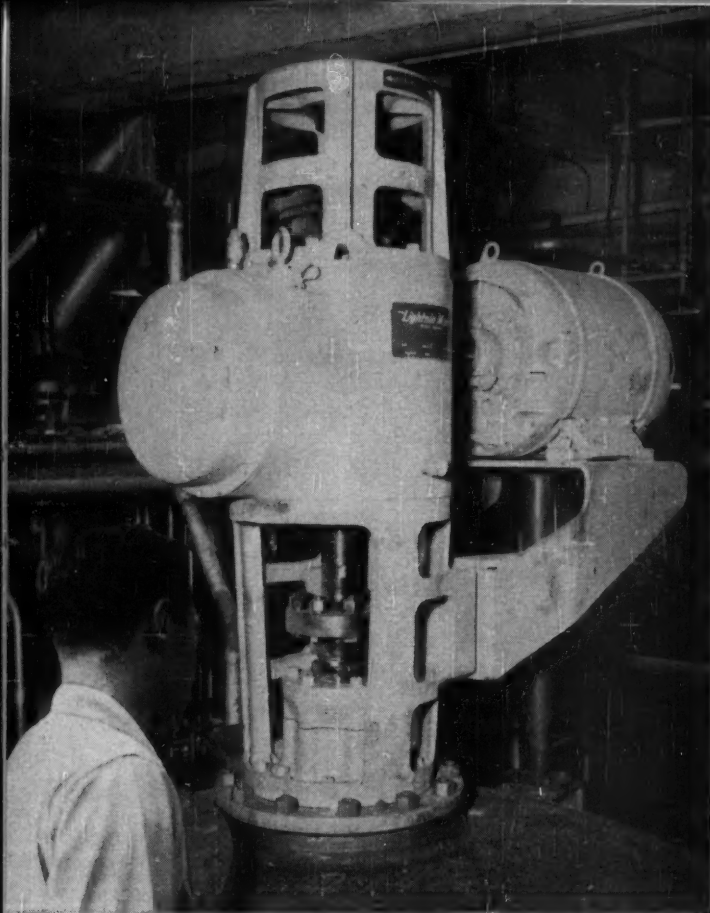
Standard Oil of California will build a \$16 million ammonia-nitric acid unit at Richmond, Calif., to take advantage of byproduct hydrogen from nearby oil refineries. A subsidiary, California Spray-Chemical Corp., is constructing another plant to convert part of the output into pelleted and liquid fertilizers. Standard will produce 300 tons of ammonia daily for use by CalSpray.

And near St. Paul, Minn., St. Paul Ammonia Products, Inc., plans a new \$15 million ammonia plant, expects to start operating by April 1956. Capacity will be 200 tons a day of nitrates, anhydrous ammonia and nitrogen solutions.

Power Plant to Use Coke From Fluid Unit

The new 130,000 bpd. oil refinery planned by Tide Water Associated Oil Co. just south of Wilmington, Del., will incorporate the world's first new power plant using byproduct coke from the fluidized coking process developed by Esso Research and Development Co. (*Chem. Eng.*, Oct. 1953, p. 126). Designed by Riley Stoker Corp., Worcester, Mass., the steam generators (three of them) will each have a rated capacity of 500,000 lb. of steam per hr. at 950 F. and 1,425 psig.

Initial refinery operations are expected by late next year. C. F. Braun & Co. is consulting engineer for the new plant.



IF YOU CAN USE A WRENCH, you can replace a LIGHTNIN rotary seal in a few minutes. The mixer stays on the tank. Just unbolt and lift out this one-piece cartridge assembly; bolt a new one in its place; you're back in operation.

SMOOTH RUNNING. Prelubricated mixer shaft bearing (A) is part of seal assembly, close to seal for proper shaft support. But seal lubricant chamber (B) is separate from bearing—so you can choose best seal lubricant for your needs, without regard to bearing lubricant. Seal is stocked in wide range of designs and corrosion-resistant materials.

NEW LOOK in fluid mixing. This seal cartridge takes the place of a stuffing box; runs for years without adjustment; handles pressures to 1200 psig, temperatures from -120°F. to $+485^{\circ}\text{F.}$ Seals are optional equipment on LIGHTNIN top entering, side entering, and bottom entering mixers.

Newest cost-saver for fluid mixing:

End stuffing box repacking . . . forever *with a rotary seal that's easy to replace*

You may get a whole new concept of the ease of mixing fluids under pressure or vacuum, when you read this story.

For here is a rotary seal that gives you leakproof, low-maintenance fluid mixing for years, under most conditions.

Yet anyone can replace this seal in a few minutes, if necessary. Without dismantling or demounting the mixer. Without draining the tank. And without special skill.

Here's what you gain when you specify LIGHTNIN Mixers with new LIGHTNIN Seals:

1. You end leakage—for good. The seal

positively will not leak during its operating life. You can get standard LIGHTNIN Seal assemblies to handle pressures as high as 1200 psig; temperatures from -120°F. to $+485^{\circ}\text{F.}$ Special designs are available for more extreme conditions.

2. You eliminate the cost of repacking stuffing boxes. The LIGHTNIN Seal takes the place of a stuffing box. Under most conditions, it runs for years without changing.

3. You stop costly "nursing" of stuffing boxes. The seal never needs adjustment.

4. You can replace a LIGHTNIN Seal in a

few minutes, should it ever become necessary. Only one cartridge component to unbolt and replace—and you're back in operation. Anyone who can handle a wrench can do it.

Already, many chemical processors are using LIGHTNIN Seals.

Users report maintenance savings running into many thousands of dollars yearly.

Your LIGHTNIN Mixer representative can give you the full story—show you how much you can save. Call him today. Or get the facts by mail: Send the coupon for 8-page, fully illustrated bulletin.

Lightnin®
Mixers

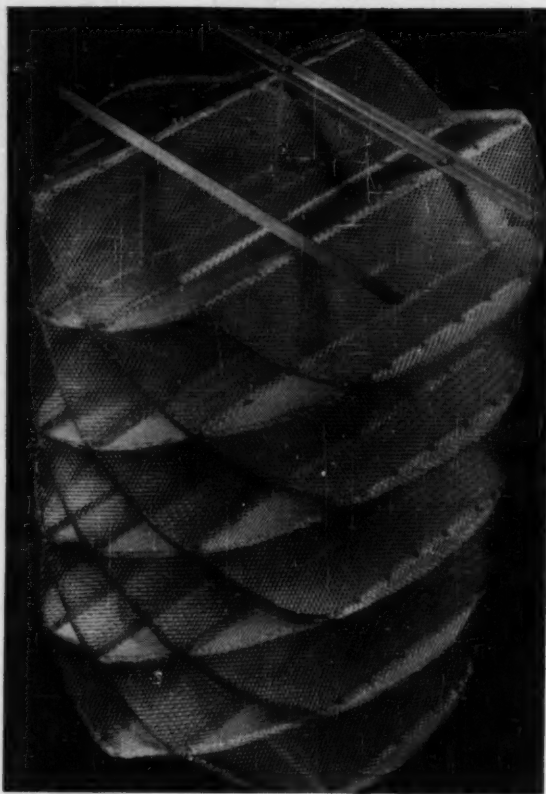
MIXCO fluid mixing specialists

Get the cost-cutting facts now . . . New 8-page Bulletin B-111 shows how you get maintenance-free sealing that really slashes fluid mixing cost to a new low. Send also for LIGHTNIN Mixer catalogs listed here. Free—no obligation. Just check data you want, tear out and mail to us today with your name and company address.

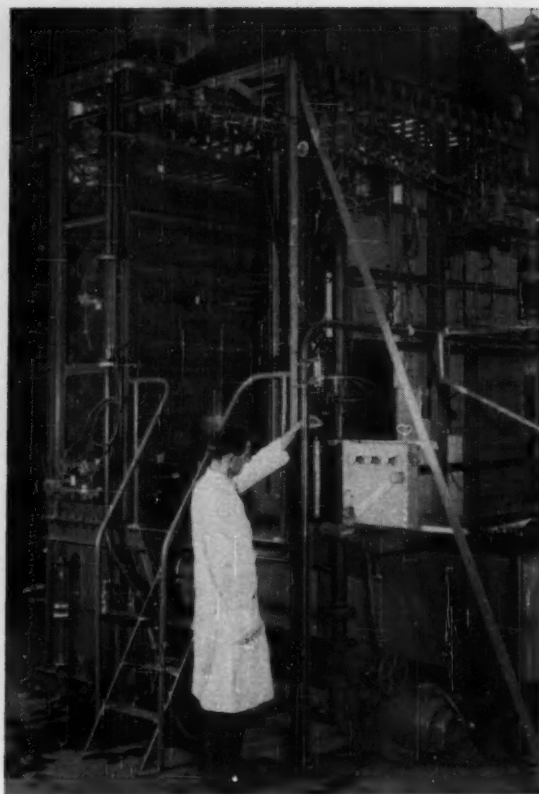
- ☐ B-111 LIGHTNIN Rotary Mechanical Seals
- ☐ DH-50 and DH-51 Laboratory Mixers
- ☐ B-102 Top Entering Mixers (turbine and paddle types)
- ☐ B-103 Top Entering Mixers (propeller types)

- ☐ B-104 Side Entering Mixers
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In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Ave., Toronto 10, Ont.



FORMED of expanded-metal elements . . .



TESTED in this transparent tower . . .

New Tower Packing Shows High Throughput

Chemical engineers in England needed a low-cost, high-capacity packing for making heavy water. They developed this one to fit the requirements.

One of the latest chemical engineering advances to emerge from nuclear energy research is Spraypak, a new type of distillation tower packing.

Developed by workers at Britain's Atomic Energy Research Establishment, Harwell, this packing is made from sheets of expanded metal formed into a cellular assembly, as seen above.

Spraypak's construction and performance were disclosed recently at a meeting of the Institution of Chemical Engineers in London.*

* By J. A. McWilliams, H. R. Pratt, F. R. Dell and D. A. Jones.

► **For Heavy Water**—The new packing was developed to fill the need for a low-cost, high-efficiency, high-capacity packing suitable for large-scale separation of hydrogen isotopes by distillation of water.

To get one ton of heavy water by distillation at atmospheric pressure, 330,000 tons of water must be evaporated. Even though steam from geothermal sources in New Zealand may be available at practically zero cost, the cost of conventional distillation towers for large-scale production of heavy water is so high that capital charges alone are enormous.

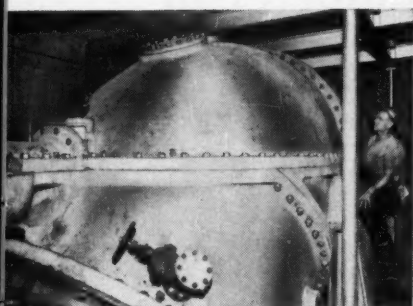
The British workers were first attracted by the large throughput permissible with an older type of expanded-metal packing, Pan American Refining Corp.'s Panapak. After investigating Panapak, they proceeded to develop Spraypak. Basic difference between the two packings is that Spraypak is made of single layers of expanded metal, whereas Panapak uses multiple layers.

► **Construction Details**—For most applications Spraypak is made from commercial $\frac{1}{8}$ -in. nominal mesh 20 to 24-gage expanded metal of $\frac{1}{8}$ -in. strand width. The material is formed into Z-shaped elements which are bolted, welded or clipped together, aided by vertical rods and spacers, to form a continuous cellular structure.

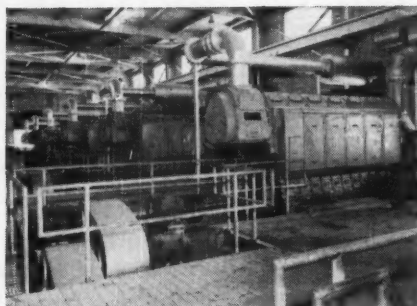
In an alternative form of con-



World's largest pumping station tames Everglades



Each giant 89-ton pump is equal to the floor space of the average-sized living room. The huge four-bladed, air-foil propeller moves water through the pump at the rate of 360,000 gallons a minute.



Six 1600-hp. Fairbanks-Morse Opposed Piston Diesel Engines insure uninterrupted power for the big pumps, especially during storm periods when they will be most urgently needed.

Floridians who have counted their flood loss in thousands of lives and millions of dollars bitterly refer to Lake Okeechobee as the Killer Lake.

Now, with the completion of the world's largest self-powered pumping station, there is the promise of forever taming the Everglades' rampaging waters.

Located at the southern tip of the lake, the station houses six of the world's largest pumps . . . built by Fairbanks-Morse . . . powered by Fairbanks-Morse Opposed Piston Diesel Engines.

Each pump can deliver over 500 million gallons a day. That's more water than is consumed each day by the entire population of Florida. Put all six of these giant 89-ton pumps in operation and you can pump nearly three times the daily consumption of the city of New York.

We at Fairbanks-Morse are proud to be a part of one of the largest engineering projects on the face of the earth—and the country-wide acceptance it typifies. This endorsement and wide selection in the F-M line of 50,000 pump models assures you of finding the *one* pump best suited to your pumping requirements. When next you need a pump, look for the one made by the world's largest pump manufacturer—Fairbanks-Morse. Ask your nearby Fairbanks-Morse Field Pump Engineer for assistance on your specific problem, or write to Fairbanks, Morse & Co., 3601 Kansas Avenue, Kansas City, Kansas.



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WHAT'S HAPPENING . . .

struction the short sides are bent in such a way that, when clipped together, the cell intersections are vertical instead of horizontal.

Modified forms of construction have also been devised suitable for installation through tower man-holes.

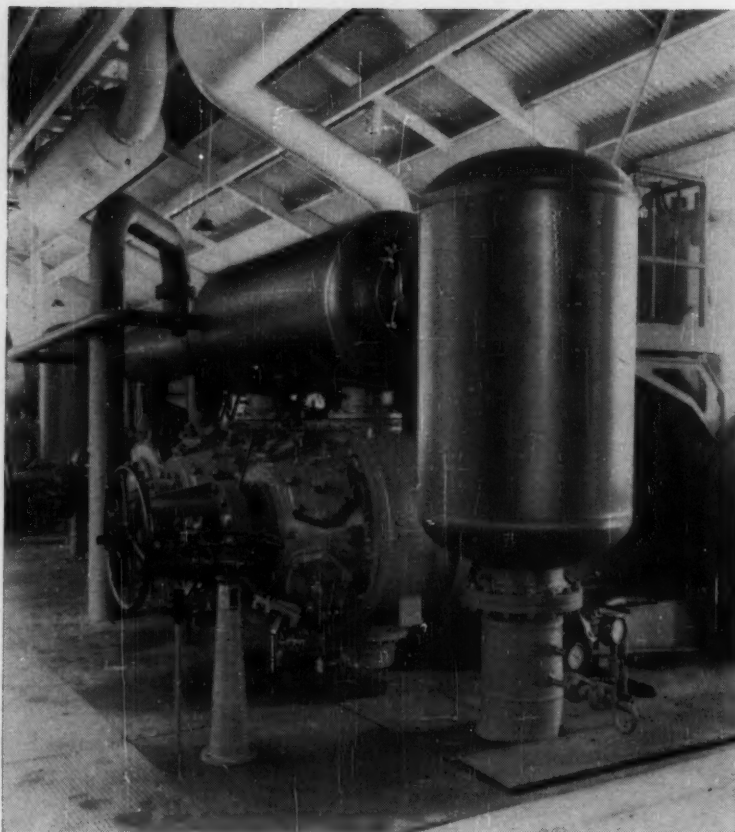
The British workers built packs from several types of expanded metal and tested them in an air-water rig to determine the optimum type. They made further tests of different packing geometries in a distillation unit. Both test units were rectangular in cross-section (15 by 27 in.); the transparent air-water unit had a packed height of 4 ft., the steel distillation unit, 20 ft. A later transparent rig for studying liquid distribution (see cut) had a cross-section 2½ ft. by 7½ ft. and a packed height of 8 ft.

► **Performance Details**—In air-water tests at low liquid and gas rates, the liquid was observed to run as a more or less continuous film over the cell walls. At higher liquid rates some of the liquid tended to stream through the packing mesh from cell to cell. As the gas rate was increased the streaming ceased, and the liquid film was disrupted with the formation of bubbles. At rates above 20% of flooding the film became detached from the upper portion of the cell walls and began to spray.

In distillation tests at total reflux, spraying began at about 25% of flooding, was virtually complete over all the surfaces at about 35%.

Typical flooding rates reported by the Harwell workers for the H₂O-HDO system ranged from 2,050 to 2,420 lb./hr. (sq. ft.), and for the benzene-carbon tetrachloride system, from 6,100 to 6,230 lb./hr. (sq. ft.). Pressure drop at flooding was about 2 to 3 in. water per theoretical plate and height equivalent to a theoretical plate (H.E.T.P.) was in the range of 1 to 2 ft. at flooding.

Although most of the work to date has employed Spraypak made of aluminum mesh, its developers point out that Spraypak made of stainless steel is entirely practical. This would open up many possible uses in the process industries.



Using Massive Snubbers . . . to Simple Earplugs

Industry Moves to Dampen Din

Spurred by recent court awards on hearing loss claims and fresh evidence of boosted worker efficiency, noise reduction is recruiting disciples in industry.

Several recent court decisions which awarded compensation for hearing loss—despite the fact that the deafened persons lost neither work-time nor earnings as a result of their impairment—furnishes a new incentive for engineers to combat plant noise. In addition, more liberal claims laws, strongly supported by the unions, are on this year's legislative calendar in many states.

Even aside from the threat of compensation suits and potential

claim losses—often in thousands of dollars—the engineer has other motives for lowering noise levels. Companies throughout industry have found that noise abatement pays off in boosted morale, lower employee turnover and reduction in employee fatigue—thereby boosting efficiency. All are tangible benefits.

► **Job for Engineers**—Physicians, sociologists, industrial hygienists, psychologists, even lawyers, have long been concerned with the problem of industrial noise control.



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**designed for 75 lbs. per sq. in. working pressure
stores anhydrous ammonia**

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Canceling Sound

An interesting sidelight in the war against noise is now in the development labs.

It's a new machine which determines the frequency and character of an existing sound wave, then it sends out its own sound of the same frequency but of opposite phase. Interference results and the waves cancel each other, giving a localized cone of silence.

Industry, on the other hand, has been chided for dragging its feet. According to the managing director of Mellon Institute's Industrial Hygiene Foundation, C. Richard Walmer, industry accepts noise as "the necessary accompaniment of production."

But companies who have tried to eliminate some of this "accompaniment" have found that hushing the noise significantly improved employee efficiency. Such findings, plus the possibility of lawsuits, are spurring industry to cut noise to workable, livable levels.

Spearheading industrial efforts are the engineers. Although the chemical industry as a whole has been lagging, a few organizations have been working on noise control. Both the engineering and medical staffs of Du Pont have studied the subject for a number of years. Eastman Kodak, too, has been working to control unwanted sound. Others active in the field include Armour Research Foundation, American Standards Association and the Acoustical Society of America.

► **Tough Problem**—The latter two organizations have worked on the problem since 1932. They've adopted a batch of standards for sound-testing equipment. And they're keeping a number of special committees busy on dozens of related projects.

Setting standards is one of the toughest aspects of noise control. This is because individuals differ so markedly in their susceptibility to noise and in their ability to recover from an exposure.

► **Being Licked**—Lack of widespread hearing-loss standards has not deterred some companies from acting. There are a number of ways by which they are actually controlling noise:

- **Eliminating at the source.** Ordinarily the most difficult and most expensive method, since it often involves redesign of the noisemaker, many equipment vendors are doing this with their products.

- **Segregating noisemakers.** Although in many industries this is normal practice, in the chemical industry few plant layout planners are paying attention to it. Concentrations of noise producers cause the toughest problems. Bunching a group of noisy ball mills, pumps or compressors effectively thwarts control measures. Spreading them out, even moderately, has been found to make noise reduction practical.

- **Dampening vibrations.** Annoying low-frequency vibrations from grinding, pounding and wearing equipment have been effectively dampened by using vibration-absorbing mounts. Users insert these between the equipment frame and the floor or support. Made of a resilient material or coiled steel, they prevent the transmission of vibration to the supporting structure.

- **Enclosing the noisemaker.** Firms which have tried noise reduction report that enclosing is just about the best way to quiet motors, gears, and other types of machinery.

- **Trapping noise.** Many companies (like Union Oil, see cut, p. 128) use pulsation snubbers to quell compressor noise, or put silencers—steel cylinders lined with sound absorbing material—around vents to silence escaping steam.

- **Treating surroundings with acoustical materials.** For years this technique has been used to quiet offices, but now it is moving into the plant. Made of acoustical materials, sound baffles are used by some companies to do the job. They are hung inexpensively at critical points in the plant to cut noise spread and reduce reverberations.

- **Using individual ear plugs.** All too often a last resort measure, companies which use them report

ear plugs a cheap, effective solution to many difficult situations.

► **Can Be Done, But**—The range of materials and techniques available today makes it possible to throttle any type of noise. Sometimes this is easy, often it's difficult, always it costs money. One of the hardest problems facing the engineer trying to cut noise is proving that abatement will pay its way.

Evidence is piling up that increased worker efficiency is a tangible result of abatement practices. And, as hearing loss claims mount, noise control will be looked upon as a form of insurance against future lawsuits.

It's not necessary to tone a process plant down to library-like quiet, but a modicum of noise-reduction engineering; intelligently applied, can pay off in boosted worker efficiency and morale—as well as averted claims.

Convention Calendar

American Institute of Chemical Engineers, national meeting, Shamrock Hotel, Houston, Tex., May 1-4.

National Association of Corrosion Engineers, Hotel Statler, New York, May 9-11.

Tenth Purdue Industrial Waste Conference, Purdue University, Lafayette, Ind., May 9-11.

American Petroleum Institute, 20th midyear meeting of Division of Refining, Jefferson Hotel, St. Louis, May 9-12.

American Institute of Chemical Engineers, New Jersey Section's sixth annual symposium—Ion Exchange, New Applications of Chemical Engineering, Control of Industrial Stream Pollution—Hotel Essex, Newark, N. J., May 10.

Achema XI—Chemical Engineering Exhibition and Congress, Frankfurt, Germany, May 14-22.

National Materials Handling Exposition, International Amphitheatre, Chicago, May 16-20.

Chemical Market Research Association, annual meeting, Hotel Plaza, New York, May 18-19.

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During the past five years Oronite Isophthalic, produced from a pilot plant, has been thoroughly field tested by a number of major resin producers with outstanding results. Paints and varnishes have shown improved qualities of durability, hardness, water resistance and quicker drying. Tougher, stronger, more heat resistant polyesters have also been produced.

The new Oronite Isophthalic plant is now well under construction with completion date scheduled for October. It will pay you to investigate Oronite Isophthalic now.

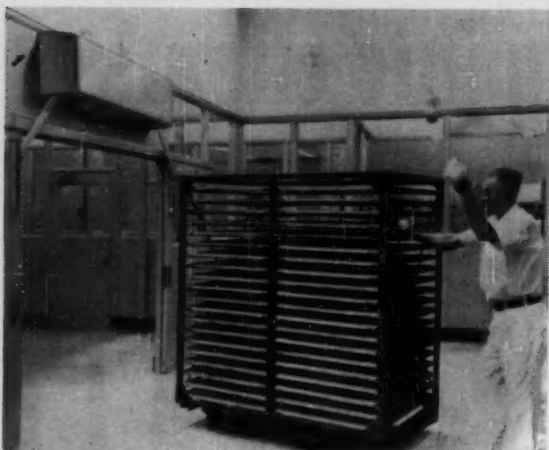
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PULL-CORD, at Upjohn Co.'s pharmaceutical plant, or . . . FLICK OF A SWITCH are just two ways of . . .

Opening Doors for the Process Industries

Recent survey points up the growing importance of automatic and semi-automatic equipment for opening and closing swing and slide doors.

Following the lead set by commercial shops and buildings, the chemical process industries are fast recognizing the advantages of automatic door operators and controls to:

- Eliminate drafts—and control temperature and humidity.
- Speed traffic flow.
- Minimize noise and odors.

A recent survey conducted by National Pneumatic Co., Boston, among a selected group of its customers, points up the growing importance of equipment which opens and closes swing and slide doors with a flick of a switch, pull of a cord, or breaking of an electric-eye beam.

According to James J. Anderson, National Pneumatic's general sales manager, most industrial users of automatic door operators originally installed them to handle special problems. Their primary purpose was achieved in every case. But the extra benefits were the real payoffs.

Throughout the survey, companies reported gains that add up to impressive figures in tangible terms

—savings in manhours, reduction in air-conditioning costs, increased output.

Here's how some typical chemical plants have put these automatic doors to work:

► **Pharmaceuticals** — In Upjohn Co.'s plant in Kalamazoo, Mich., automatic operators and controls maintain careful humidity and temperature control and segregate sterile areas.

Upjohn reports considerable cuts—as high as 10-15%—in air-conditioning costs and has special praise for the doors as time-savers.

A similar report comes from Ciba Pharmaceutical Products' plant in Summit, N. J., where automatic door equipment gives greater temperature control between air-conditioned and non-air-conditioned areas and speeds up flow of materials.

The equipment also helps keep odors of the animal quarters (in the microbiology research building) from permeating other buildings.

► **Fibers**—At its Narrows, Va.,

plant, Celanese Corp. of America uses automatic door operators in three areas:

- Production rooms (textile, beaming, staple departments)—doors improve temperature control, reduce drafts.

- Main laboratories—foot-controlled doors are a boon to workers carrying fragile objects.

- Shipping and storage areas—automatic operators with electrical manual controls eliminate the need for drivers to dismount from the truck to open and close doors. They free hoist operators' hands so that they can guide overhead beams.

Plant Manager S. A. Mansfield says, "We have no available figures, but these automatic operators definitely save time in transportation of our products."

Other improvements include: Raising employee morale and lowering absenteeism through improved working conditions, reduced handling damage to materials and longer life for equipment.

J. J. Kelly, plant engineer at Taylor Fibre Co., Norristown, Pa., cites similar advantages in his plant. He reports that automatic equipment not only speeds traffic and saves heat, but also makes "for better working conditions for employees."



ANHYDROUS AMMONIA... 250 tons per day

by the exclusive



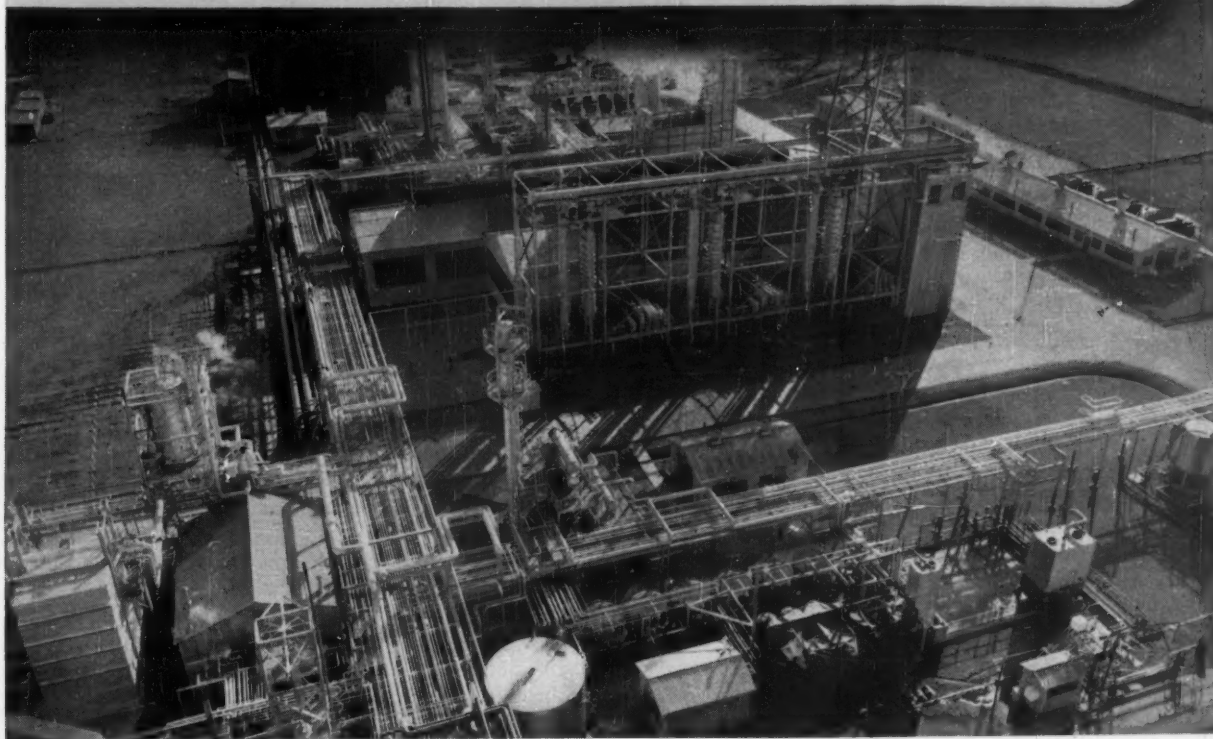
sequence

*Another Ammonia Synthesis
Plant by Foster Wheeler
now on stream at
Grace Chemical Company*

Designed and built by Foster Wheeler, this modern Grace Chemical Co. plant at Memphis, Tenn. has a capacity of 250 tons of anhydrous ammonia per day.

It is another outstanding example of the proved economy and dependability of the FW Sequence — Texaco partial oxidation, FW liquid nitrogen wash and Casale ammonia synthesis. Write for the March-April issue of *Heat Engineering*, containing the complete story. Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.

FOSTER WHEELER



WHAT'S HAPPENING . . .

► **Paper Products**—A special safety problem at Nashua Corp.'s plant in Nashua, N. H., was successfully solved by a National Pneumatic operator and pneumatic control, manually operated by pull cords at three stations.

The door—of approved sliding fire-door construction—is set in a fire wall which separates an area filled with flammable, explosive equipment and materials from a room with controlled humidity. The door control is also attached to a special fusible link which will automatically break to insure the door's closing in case of fire or explosion. Thus the danger area can be isolated.

Nashua's chief engineer, George F. Gordon, adds that automatic operation of the door at the shipping dock "allows 10-15% more goods to pass through during the same period of time as was possible when the door was manual."

Better than 90% of all those responding to the survey report gains comparable to those mentioned above. National Pneumatic feels that these gains indicate development of the automatic door operator as "standard" in a continually widening area of industrial planning—one which is becoming more and more automation-conscious.

Dow Starting Dutch Operations

With permission of the Netherlands Government, Dow Chemical Co. is establishing a wholly owned subsidiary in Rotterdam—Nederlandsche Dow Maatschappij N. V. Dutch approval includes rights to import, produce and distribute (both in Holland and abroad) chemicals, plastics and magnesium.

Dow plans to build a small manufacturing plant in Rotterdam, plus storage and dock facilities. Total initial investment in the new subsidiary will be \$500,000, with possibly another \$800,000 by the end of 1955.

Major products to be produced by Dow in Holland include polystyrene, magnesium alloys and glycols. And it's expected that these will be

delivered from Rotterdam to European markets in 3-6 days once operations get going. Certain basic raw materials will be shipped from Dow's U. S. plants in leased tankers. The rest will be obtained from Dutch or other European sources.

First Use of Partial Oxidation on Fuel Oil

A new ammonia plant about to be built at Searsport, Me., by Northern Chemical Industries will mark the first use of Bunker "C" fuel oil as raw material for the Texaco-Hydrocarbon Research partial oxidation process for ammonia synthesis gas. The plant will also be New England's first anhydrous ammonia plant of any kind.

The Searsport plant is expected to cost \$9 million and to be capable of making 43,000 tons of anhydrous ammonia annually (125 tons a day). Of this, about 18,000 tons will be used to produce 32,000 tons of nitrogen solutions for manufacture of mixed fertilizers; the rest will be sold to nearby sulfite pulp producers. Girdler Co., the prime contractor, is also putting up a 60-ton-per-day nitric acid plant, a complete nitrogen solutions plant and a 7,500-kw. power plant for NCI at Searsport, making the plant completely self-sustaining.

More Attempts at Coal Carbonization

Two organizations are about to try out new low-temperature coal carbonization processes.

Cotarco, Inc., a subsidiary of International Resources Corp., says it will build in Colorado an \$11.5 million low-temperature carbonization plant to process 8,520 tons daily. The process to be used is licensed from F. E. Poindexter, retired St. Louis University director of physics, and Frank Lowe of St. Louis (U. S. patents 2,615,834 and 2,697,068).

In this process coal particles move across a nearly horizontal heated metal plate (about 950 F.). Unlike other methods, though, this

one is claimed to increase greatly the amount of heat absorbed by the coal through violent mixing—not fluidization. This will be accomplished with curved paddles (20,000 cycles per hr.) that lift coal particles from the hot plate, throw them upward in the reactor and allow cooler particles to come in contact with the plate.

Henry Haas, vice president of Cotarco at Denver, estimates the plant's daily output will be 5,930 tons char, 15 million cu.ft. fuel gas (645 Btu.), 71,000 gal. acid oil, 6,400 gal. light oil, 57,300 gal. creosote oil, 72,000 gal. pitch and 67 tons sulfur.

The other new project is being undertaken by PDP Co. of Lewiston, Idaho. Using research done at Montana State College, the firm will build a \$100,000 char plant to get chemical byproducts. It has been operating a one-ton-per-hour pilot plant.

IMC Completes One Project, Starts Another

At Niagara Falls, N. Y., International Minerals & Chemical Corp. has just finished a \$2 million expansion program. Chlorine capacity is up 25%, to 25 tons a day, and capacity for liquid caustic potash and potassium carbonate has been doubled. Also added was a new unit to produce 60 tons daily of 20 Be. hydrochloric acid.

And at Carlsbad, N. M., IMC is increasing potassium sulfate facilities by 40,000 tons a year—to 150,000 tons. This increased capacity should be ready by June 1.

Pigments, Carbon Black Plant Starts Operating

Strategically located in Orange, Tex., a new plant to supply polyethylene makers with dispersions of pigments and carbon black has been put on stream by Acheson Dispersed Pigments Co., a subsidiary of Acheson Industries, Ltd. One of the local functions will be to add color to polyethylene before it's processed into finished products. Carbon black is added to increase the plastic's life.



Swenson Long-Tube Vertical Evaporators Booklet on high-capacity, steam-saving evaporators for concentrating mobile and foamy liquids and heat-sensitive materials.

Bulletin E-100



Swenson Forced Circulation Evaporators 8-page bulletin tells about Swenson "F.C." evaporators for continuous economical concentration of viscous, salting, and scaling liquors.

Bulletin E-107



Swenson Spray Drying Equipment 16 pages of facts, photographs, and diagrams explaining principles and advantages of spray drying and the Swenson plant-scale research laboratory.

Bulletin D-105



Swenson Research Spray Dryer A folder that describes and illustrates Swenson's completely packaged spray dryer for laboratory and pilot plant operations.

Bulletin D-106



Swenson Rotary-Drum Vacuum Filters Describing and illustrating Swenson job-engineered filter equipment for continuous low-cost, efficient filtration and washing.

Bulletin F-100



Swenson Top-Feed Filter An illustrated folder presenting Swenson's efficient, money-saving top-feed filter equipment that dewater and dries crystalline materials in one process.

Bulletin F-101



Swenson Vacuum Crystallizers An 8-page booklet . . . describes Swenson crystallizers—individually engineered for minimum cost, maximum recovery of crystals, top quality of product.

Bulletin C-100



Swenson Recovery Equipment for Pulp Mills Illustration, description and discussion of Swenson pulp washers, explaining advantages of advanced engineering features.

Bulletin E-108



Heat Transfer and Crystallization A 52-page book giving practical presentation of the fundamentals of modern evaporation and crystallization methods and equipment.

Bulletin E-106

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AND
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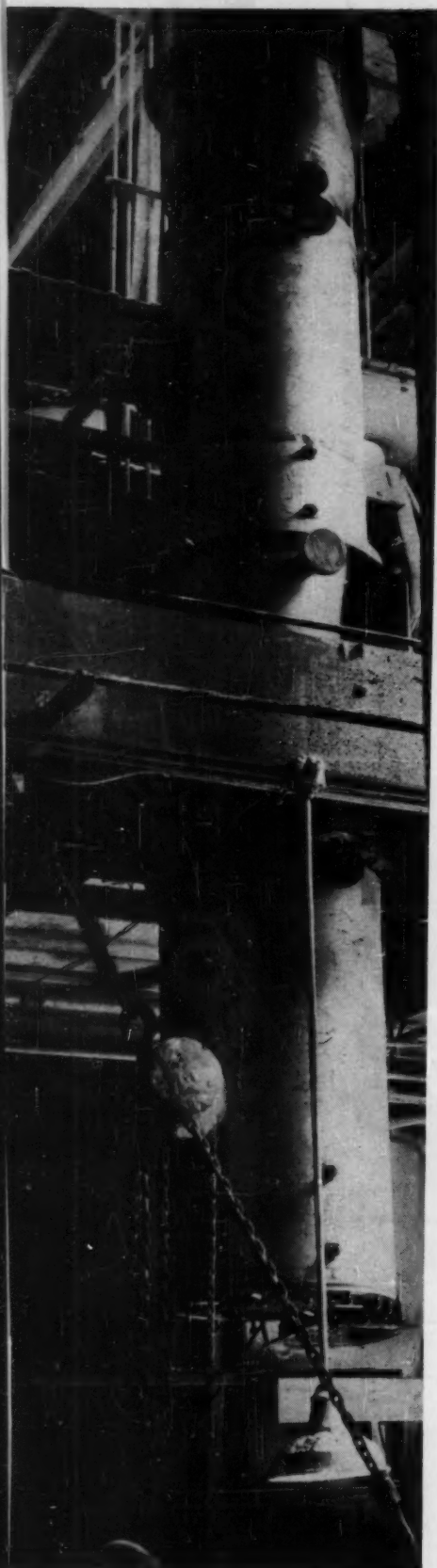
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Evaporator Catches On Fast

Designed to evaporate heat-sensitive, viscous and foaming materials, this new unit is getting a ready reception in the chemical industry.

Processors of tricky-to-evaporate materials have long looked for an improved way to concentrate these substances—one that would give them high heat-transfer rates and short in-process times on a continuous basis.

Judging from the wave of recent installations, they seem to have found what they sought in the Turba-Film continuous vacuum evaporator. This is an agitated, falling-film unit invented in Switzerland and developed there by Luwa S. A. Rodney Hunt Machine Co., Orange, Mass, introduced the Turba-Film into this country about four years ago.

► **Caught On**—The unit appears to have caught on in short order, and a long list of chemical processors are now using it. These include: Nopco Chemical, Celanese, Hoffman-LaRoche, Lederle and Calco divisions of American Cyanamid, Continental Oil, Shell Chemical, Rayonier, Colgate-Palmolive, U. S. Rubber, Goodrich Chemical and Tennessee Eastman.

Among the latest installations is one at the South Point, Ohio, plant of Allied Chemical's Nitrogen Div. (see cut, left). A battery of four Turba-Films, each almost 19 ft. high 2½ ft. in diameter can evaporate 3,000 lb. of water per hr., (nominal—capacity varies with concentration and material) cutting the water content of a fertilizer slurry from 20% to 6% in a few seconds.

Other installations run the processing industry gamut from antibiotics and vitamins to rubber latices and caramel candy. It's also been used to steam-refine and deodorize fats and oils.

► **How It's Built**—The Turba-Film evaporator consists essentially of two vertical, cylindrical sections, one atop the other, with the feed

inlet between. A central rotor extends from-top to bottom. Six different sizes of the Turba-Film are in use, ranging from 4 in. to 3 ft. in diameter and from 30 in. to 30 ft. in height.

Below the feed inlet is the evaporating section—jacketed for heating. Product outlet is at the bottom of this section. Longitudinal blades extend radially from the central rotor shaft to the heated wall. Clearance here is from 0.03 to 0.06 in.

Above the inlet is the separator section—equipped with stationary longitudinal separator fins located around its inside wall. The radial blades on the rotor shaft also extend up through the separator section.

Metal in the unit is usually stainless steel or other alloy.

► **How It Works**—Entering liquid or slurry feed is picked up by the rotor blades and whirled against the heated wall. The blades maintain a thin, turbulent layer of liquid over the entire heat-transfer surface—thanks to the close clearance between blade edge and the wall surface.

Action of the rotor plus gravity makes the liquid descend in a spiral path down the heated wall to the outlet at the bottom. Vapors ascend along the rotor shaft in the center of the cylinder, past the inlet, to the separator.

In the upper section, centrifugal action of the rotor blades throws any entrained liquid against the stationary fins along the wall. Here it coalesces and flows back to the heating zone. This cuts carryover of foam and entrainment to negligible levels.

Residence time depends on the size of the unit and the viscosity characteristics of the processed material, but the material will be on the heat-transfer surface no longer



This electronic Speed-omax instrument, calibrated in % ethane plus methane in ethylene, is panel-mounted in the Port Arthur control room to serve as recording teammate to the L&N Analyzer.

Infrared analysis helps Gulf to pipe "on spec" ethylene directly to consumers, without tankage or sampling

There's no costly storage—no laborious sampling or blending before shipment of the high-purity ethylene produced at Gulf Oil's Port Arthur Refinery. Operators are *certain* that the plant stream is always "on spec", as it runs from production directly to pipelines serving the ethylene-hungry industries of the Houston—Sabine River—Port Neches area.

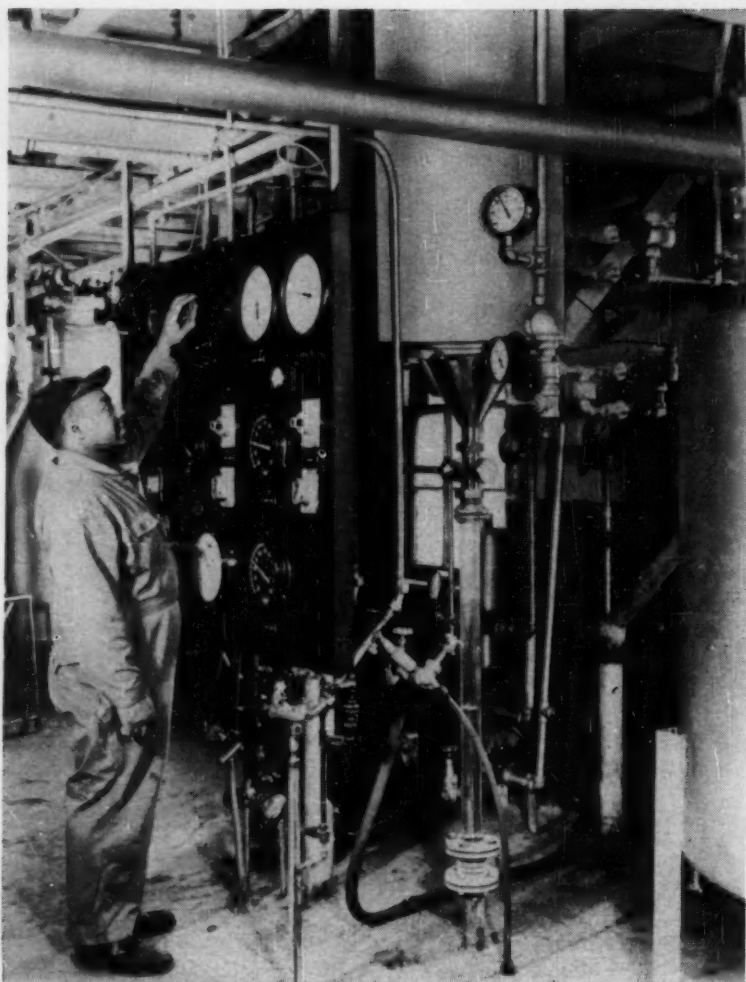
One reason for such confidence in product quality is the L&N Infrared Analyzer that Gulf has installed to constantly monitor impurities in the ethylene stream. Should the sensitive Analyzer detect a pre-determined percentage of impurity, operators can promptly divert "off spec" stream before "on spec" product in the lines can be contaminated.

Even though subjected constantly to the vibrations of a pipeline mounting, and electrical pick-up from pumps and compressors, the Analyzer checks consistently with daily spectrometer analyses—a tribute to the L&N instrument's all 'round dependability.

The Analyzer's prominent role at Port Arthur is duplicated in many other successful applications of this versatile instrument. It's measuring CO and CO₂ in the steel industry—SO₂ in H₂SO₄ stack gas—methane build-up in ammonia production—isobutane loss in petroleum. It may well be the yardstick you need in your own gas measurements.

Our Applications Lab is staffed with specialists glad to discuss your use of infrared. Outline your requirements, without obligation, in the Infrared Analysis Data Sheet we'll mail on request. Or, just write for our Demonstrator, "How the L&N Infrared Gas Analyzer Works." The address is Leeds & Northrup Co., 4916 Stenton Ave., Phila. 44, Pa.

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OPERATOR at Nopco Chemical adjusts the flow through its Turba-Film unit.

than 20 sec.—in most cases considerably less.

► **What It Can Do**—Extremely short residence time, even with highly viscous materials, makes the machine attractive to processors of heat-sensitive substances. They claim that the high heat-transfer rate and brief contact time afforded by the unit enables them to process such materials at higher temperatures without product decomposition.

Rubber producers use the machine to strip and concentrate natural and synthetic rubber latices. With natural rubber, they report feed rates as high as 180 lb./hr. (sq. ft.) when stripping ammonia from the latex at 100 F. Usual over-all heat transfer coefficient

with steam is about 300 Btu./hr. (deg. F.) (sq. ft.). With accurate control of operating conditions* users claim coefficients as high as 370.

A producer of synthetic vitamin extract gets a coefficient of 230. And a maker of resin adhesives removes water from his product with a U value of 440.

► **Some Drawbacks**—Users cite only three disadvantages for the Turba-Film:

- **High cost.** All-stainless construction and precision machining make the cost per given capacity higher than other types of evaporators.

*Rodney Hunt claims that a packaged unit with interlocked controls will hold the specific gravity of the concentrate to within 0.002.

- **Headroom needed.** Though the unit requires far less floor space than a conventional evaporator, it does need enough headroom (up to about 25 ft., depending on size) to hoist the rotor out for inspection, repair, etc.

- **Internal moving parts.** Rotor bearings, since they are internal, can be a source of trouble with some materials. Though an alternative design featuring an external bottom bearing is available. Also, clearance at the heated wall can mean trouble if solids form there.

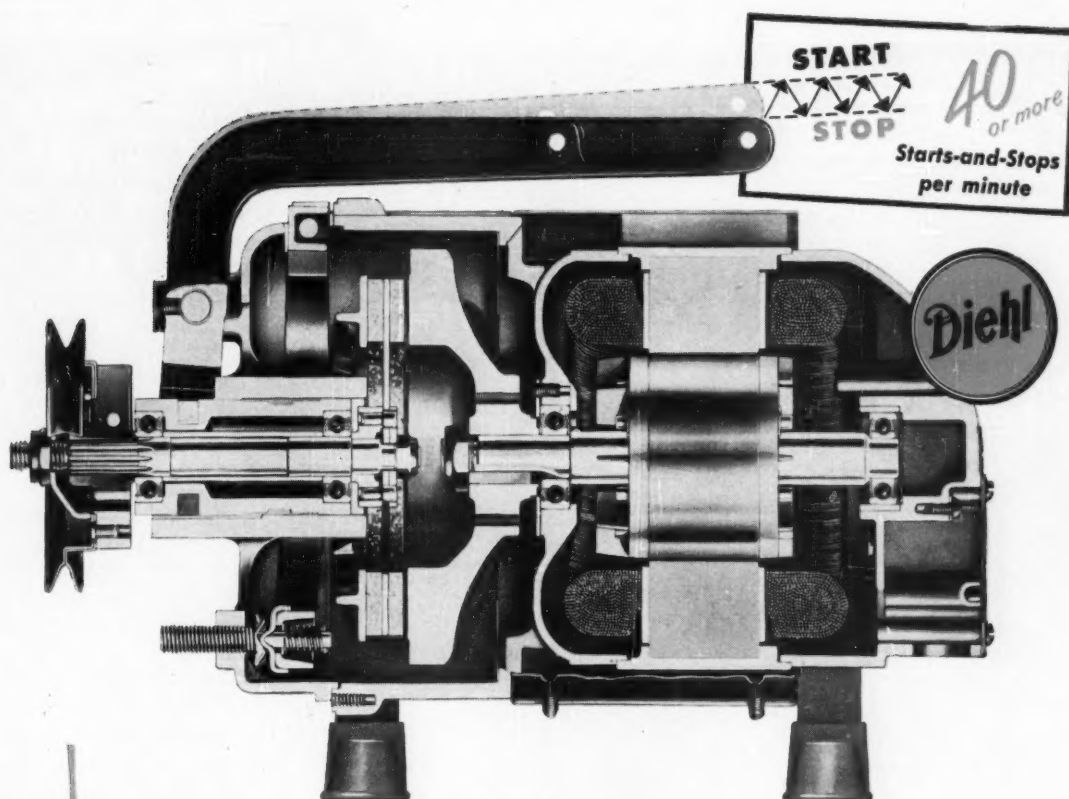
► **User Reaction**—Despite drawbacks noted by others, the first and longest Turba-Film user, Nopco Chemical Co., Harrison, N. J., is enthusiastic over the performance of its unit.

Nopco uses its single unit installation in five separate processes. In one, production of calcium pantothenate (a component of the vitamin B complex), it concentrates reaction products from 20% solids to 60-65% in less than 10 sec. This very short time-at-temperature thwarts decomposition.

But it also underlines the need for accurate and effective control of variables. Louis Rosenberg, production manager of Nopco's Fine Chemicals Div., says, "Any change in feed rate or steam pressure is reflected in our product composition within 10 sec." However, by using a system of interlocked controls, Nopco keeps concentration variations to less than 1%.

Nopco also puts an ammeter in the line to the rotor motor to prevent damage to the blades should solids form on the heated wall. If they form, or the solution becomes too viscous, the load on the motor immediately jumps. The ammeter detects this and either adjusts feed and steam flows or shuts off the machine. If the latter, solvent is circulated through the unit to dissolve the solids.

Rosenberg also points to another advantage of Nopco's unit: "Because of its simple design and stainless steel construction the unit is easy to clean. That's important to us. We can switch from turning out one product to another in minutes."



New

DIEHL Type "J" Power Transmitters

Unequalled for Repeated Start-Stop Machine Operation

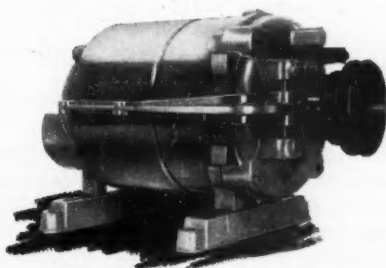
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Repeated, rapid start-stop machine operation, impractical with conventional motor drives, is now obtainable with Diehl Power Transmitters. Forty or more starts and stops per minute, hour after hour, are commonplace with these drives. Many manufacturers have made substantial increases in machine output by the shortening of acceleration and deceleration waiting periods.

In one compact unit, the Diehl Power Transmitter incorporates a totally-enclosed fan-cooled ball bearing motor; a high inertia, dynamically balanced flywheel; a positive short-throw, lever-actuated

clutch brake assembly. The actuation may be controlled mechanically or electrically.

These Power Transmitters are now used extensively on machine tools, textile machinery, winding and spooling equipment, conveyors and many other types of machinery where repeated starting and stopping is required. In countless instances, the use of Diehl Power Transmitters has made it possible to simplify machines, reduce costs, improve operation, save space and eliminate over-motoring solely for acceleration. Many of your troublesome machine drive problems may be solved with Diehl Power Transmitters.



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- ☐ Type "J" Power Transmitter Bulletin No. CE-3303.
☐ Consolidated Motor Catalog and Price List No. CE-3310

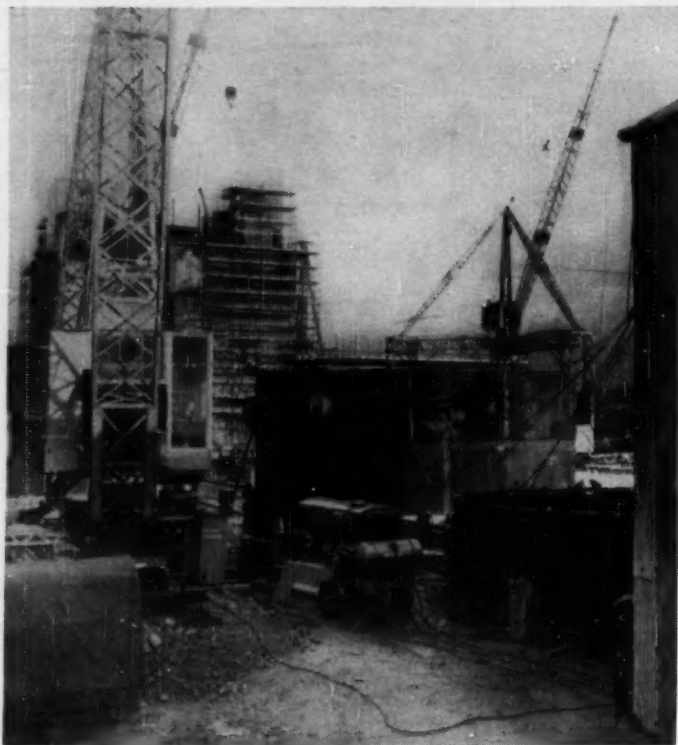
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Atomic Power Plant Nears Completion

First stage in England's new \$840 million plan to build 12 commercial nuclear power plants by 1965 is this first experimental station now rising at Calder Hall in Cumberland. Like commercial plants to follow, this unit will use gas-cooled, graphite-moderated ther-

mal reactors fueled first with natural or slightly enriched uranium.

Shown above is one of the two reactors under construction. In the foreground is part of the reactor pressure vessel ready to be put inside the 120-ft. building that will house the atomic pile.

Sinclair to Install Second CO Boiler

A "carbon monoxide boiler" that converts cat cracker waste heat to steam has been so successful at Sinclair Refining Co.'s Houston, Tex., refinery (*Chem Eng.*, April 1954, p. 114) that the company is adding one to its 34,000-bpd. fluid catalytic cracker at East Chicago, Ind.

The simple system works like this: Flue gas from the catalyst regenerator is passed into a furnace and directly fired with auxiliary gas to completely combust all

carbon monoxide. At Houston the sensible heat and heat of combustion recovered are used to produce over 300,000 lb. per hr. of 700 psig. saturated steam. Even more waste heat is recovered by sending this steam, plus some condensate, back through the kiln for superheating.

Total production at Houston is nearly 400,000 lb. per hr. of 550 psig., 750 F. steam. Auxiliary heat needed is only 110 million Btu. per hr., less than 20% of the heat that would be required to make the same steam in conventional equipment.

Lower Freight Costs For Carbon Black

A new packing process has boosted the amount of carbon black you can get into a freight car from 50,000 lb. to 65,000 lb. It was developed jointly by two New York City firms, Continental Carbon and Witco Chemical (which among its other operations handles Continental's sales). No compressing or bag shaping is required, therefore no changes occur in product properties.

Because the process is a simple, unpatentable one, its workings are being kept secret. (One possible technique would be to neutralize static electricity on the carbon black particles.) But the developers are enthusiastic about what it can do to increase the size of consignments and thus take advantage of lower freight costs whether shipments are by rail or truck.

News Briefs

Amyl Alcohols: Carbide and Carbon Chemicals Co. is now shipping tank cars of primary amyl alcohols from its new oxo unit at Texas City, Tex.

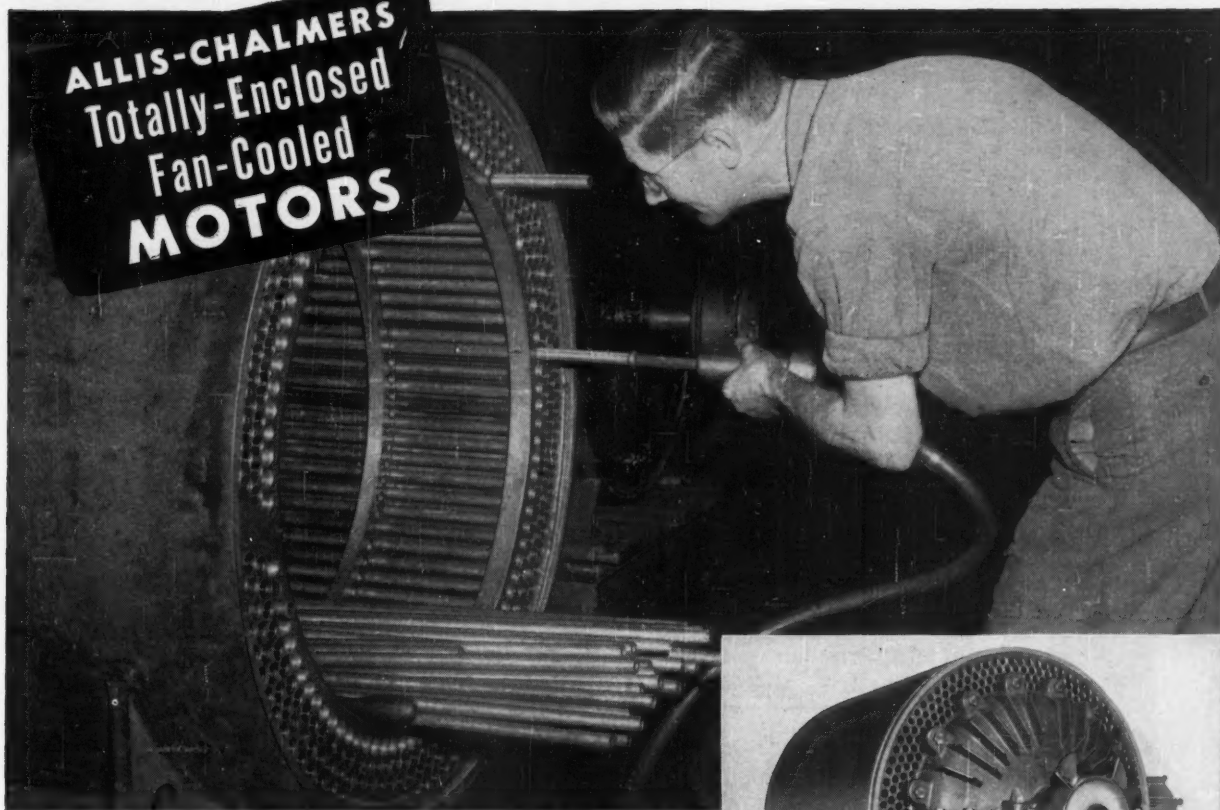
Hormones: Chas. Pfizer & Co. has developed a simple fermentation process for producing metacortandralone and metacortandracin, two new synthetic hormones for treatment of rheumatoid arthritis. (See also p. 112).

Pentasulfide: Oldbury Electro-Chemical is now making phosphorus pentasulfide—both solid and ground forms—from its new plant at Columbus, Miss.

Sulfonation: Sinclair Refining Co. is about to start building a \$2.2 million SO₃ sulfonation unit at Houston, Tex., to produce detergent lube oil additives.

Pigments: Sherwin-Williams has definitely decided to go ahead with a \$1 million plant in Chicago to make phthalocyanine pigments.

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Fan-Cooled
MOTORS**

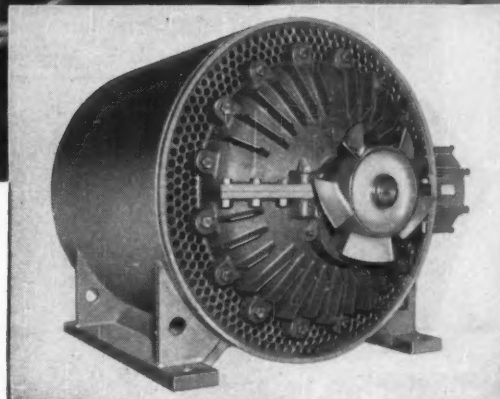


**These heat exchanger tubes
Protect this
motor from
dirt and corrosion**

COOLING AIR is carried through the heat exchanger tubes with sufficient velocity to expel practically all kinds of dirt. If oily or sticky dirt should cling, tubes can be ramrodded clean on the spot in a few minutes because tubes are straight and tube ends are exposed. Also, the tubes are distributed uniformly around the perimeter of the stator yoke and along its full length — cooling all parts of the motor evenly.

**Choice of Corrosion-resistant
Materials**

You can lick corrosion with this motor, too. Tubes are available in a variety of materials to meet practically any corrosive atmospheric condition. Allis-Chalmers tube-type motors have long and successful experience in such difficult



3600-rpm explosion-proof motor with fan housing removed to show unidirectional fan.

applications as caustic plants, refineries and petrochemical plants, power plants with fly ash problems and many others.

Get Complete Information

Next time you need a motor for a dirty or corrosive location or for outdoor operation in all kinds of weather, call your Allis-Chalmers District Office. Get complete information on Allis-Chalmers tube-type totally-enclosed, fan-cooled and explosion-proof motors. Or write Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 51B7149. Available in ratings on frames larger than NEMA 505 up to 3000 hp.

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Enjoy now foremost butyl rubber supplier

90,000 tons yearly production of Enjoy Butyl, now available from its originators, will go into varied industrial products

Enjoy Company, Inc., a pioneer and leading supplier of petroleum chemicals, will market Butyl and supply advisory service in its applications.

The low price and high-level performance of Enjoy Butyl allow it to replace natural and other rubbers now used in industry. Enjoy Butyl is the rubber that combines high resistance to aging... abrasion... tear... chipping or cracking... ozone or corona... chemicals and gases... heat... cold... sunlight... and moisture.

The new Enjoy Laboratories, located at Linden, New Jersey, are equipped to provide expert technical assistance in compounding and adapting Enjoy Butyl to individual uses and requirements.

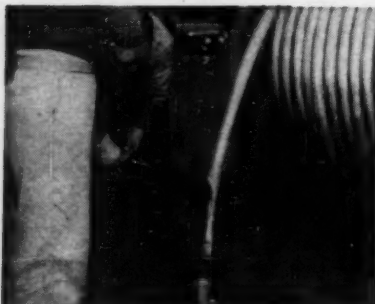
**Distinctive properties
and low price give
Enjoy Butyl wide
industrial application**



Inner tubes are made of BUTYL because BUTYL holds air ten times better than natural rubber. Its impermeability to gases promises many uses.



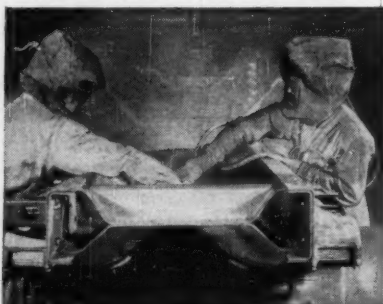
1955 cars use Butyl for dozens of rubber parts, because BUTYL has super-durable resistance to aging or deterioration on exposure to heat, cold, sun, weather, and chemicals.



High voltage electrical cables are made with BUTYL because BUTYL offers superior corona and ozone resistance, combined with excellent heat, cold, and abrasion resistance.

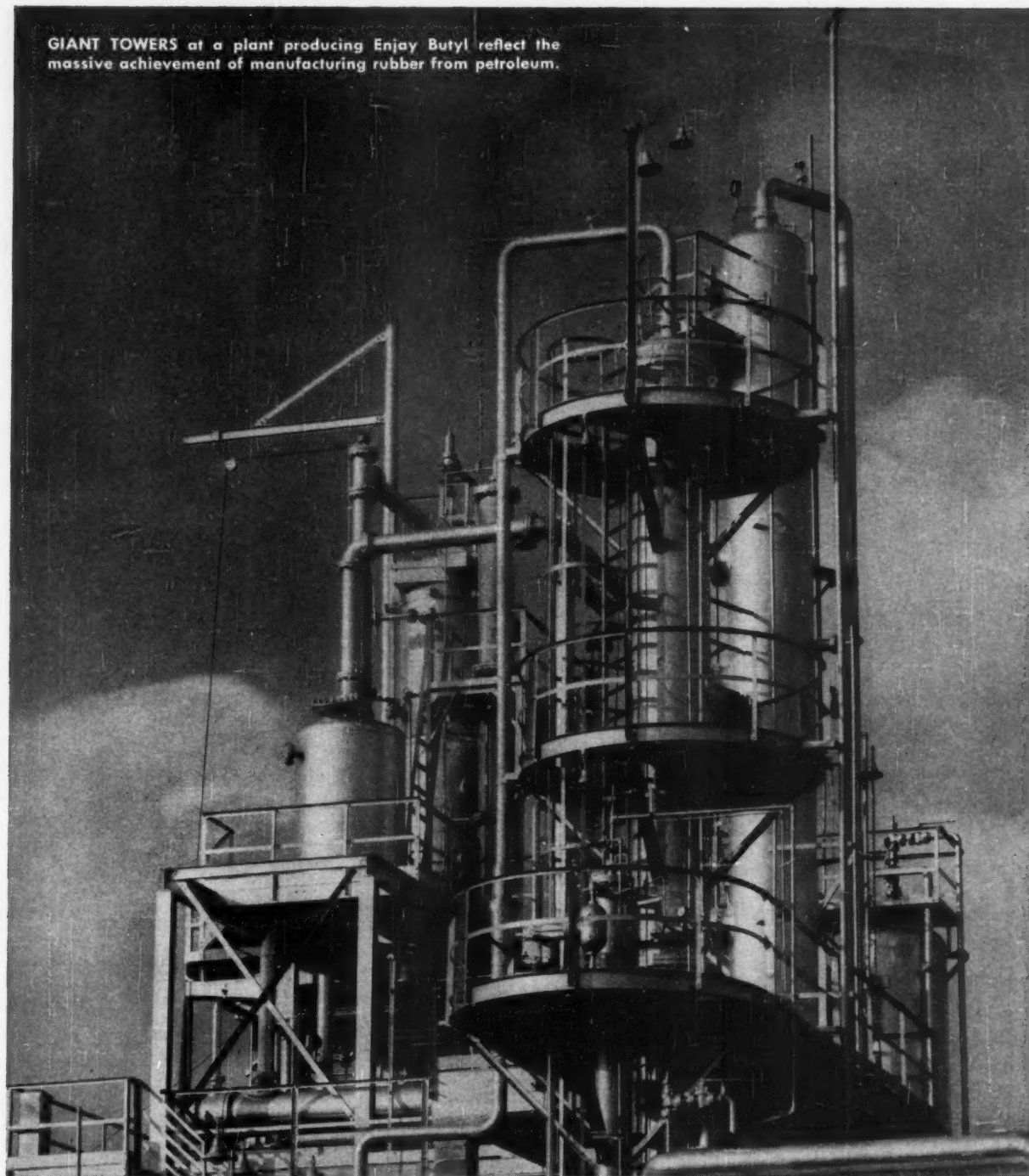


Tractor tires are made with BUTYL because BUTYL gives low tread wear and high resistance to weather, cracking, cutting, and chipping.



Protective clothing, tank linings, belt covers, hoses, and other equipment in contact with chemicals use BUTYL because of its exceptional resistance to chemicals.

GIANT TOWERS at a plant producing Enjay Butyl reflect the massive achievement of manufacturing rubber from petroleum.



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Commercial Processes

Treatment with	Yields better properties
Caustic soda	More elasticity, clinging power
Lead chromate	More resistance to sunlight
Acetic anhydride	More resistance to heat, rot, acids

Semi-Commercial Processes

Acrylonitrile	More dye receptivity, resistance to heat, rot
THPC, methylolmelamine	Flame resistance
Aminoethyl sulfuric acid	Improved dye receptivity and chemical reactivity
Monochloroacetic acid	Water solubility, greater reactivity
Bromoalkyl allyl phosphate	Flame resistance

Experimental Processes

Ethylamine	Greater chemical reactivity, toughness
Propiolactone	Better dye receptivity
Fast dyes	Water repellency, flame resistance

Cotton Treatment Spurs New Chemical Market

New chemical orders to fill, new textile products to sell—that's the two-edged potential offered by the chemical modification of cotton fiber.

Chemicals and cotton are not strangers. Usually, though, cotton emerges from their meeting either with a new wardrobe (via mercerization and/or dyeing) or a wholly new identity (e.g., viscose and acetate rayon). Seldom is it basically altered while still retaining its fibrous individuality.

Recently there's been a mounting—and, it may be fairly said, a long overdue—trend to the latter

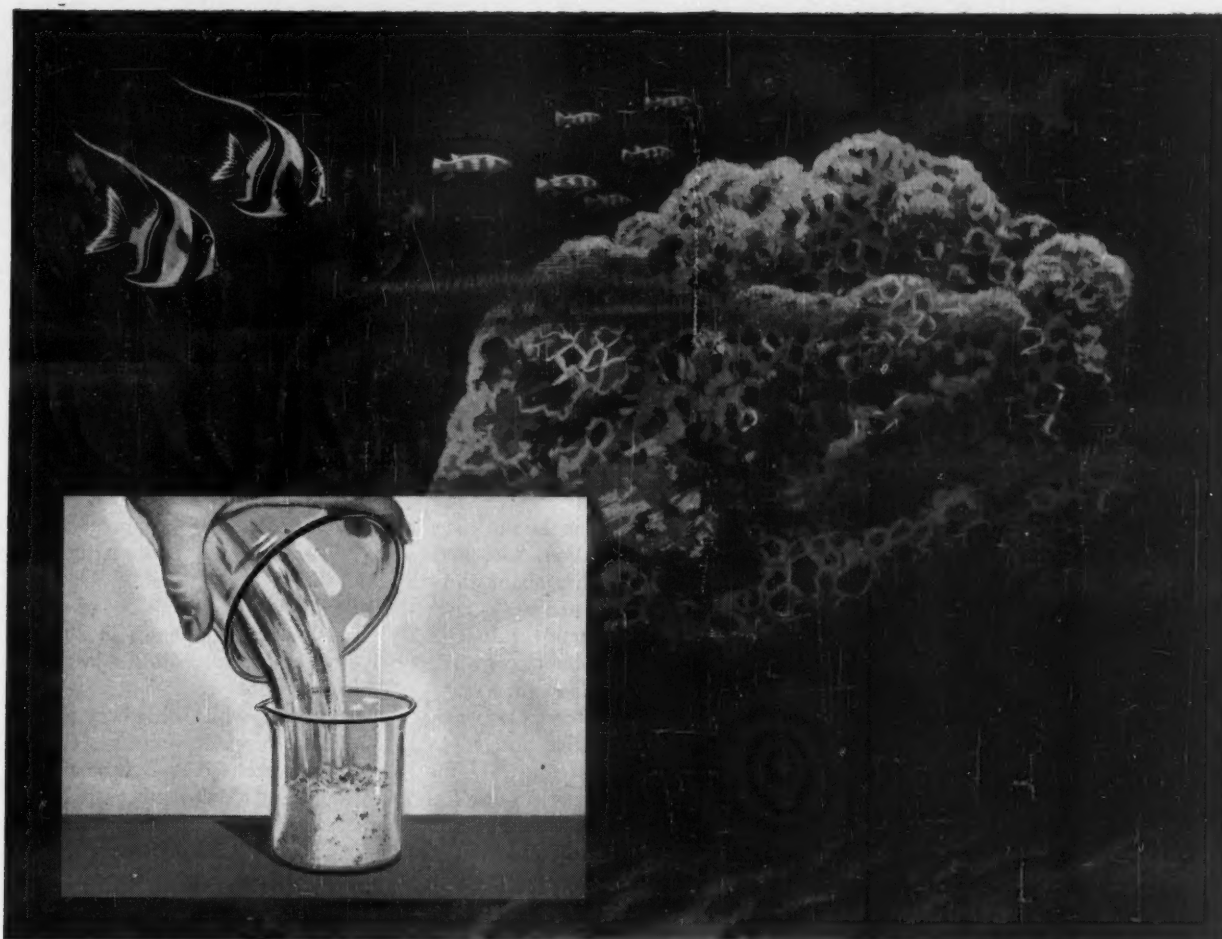
technique. Under investigation or in commercial practice are chemical conversions and modifications of fibrous cotton to yield new textile products with superior properties but which retain the original character and inherent advantages of cotton fiber.

If successful, these modified cottons will carry their chemical partners with them, will open up new markets to the industry. In recog-

nition of this, more than a little of the research and development work so far has been sparked by the makers of some of the chemicals.

But the bulk of the effort has been by groups interested primarily in extending and improving cotton utilization. One of the most prominent of these is the USDA's Southern Regional Research Laboratory, New Orleans 19, La. Southern Regional has originated or had a hand in more than a dozen chemical modifications of cotton.

► **Rundown**—Acetylation, aminization, carboxymethylation, cyanoethylation and oxidation—all these processes are being applied to cot-



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Celite diatomite powders absorb twice their own weight of liquid

Here is a material in powder form, so porous that 93% of its volume consists of tiny interconnected pores. This unique structure gives Celite* an exceptionally high absorptive capacity which is now being put to profitable use in a wide variety of industries. For example, Celite serves as a dry carrier for insecticide poisons . . . helps control viscosity in adhesives . . . and makes a highly effective anti-caking agent in fertilizers.

The unique structure of the microscopic Celite particles offers many other advantages. These particles are spiny and irregularly shaped, strong and rigid . . . as a result they do not pack together.

Thus Celite powders have great bulk per unit weight . . . making them valuable for fluffing up dry powders such as household cleansers . . . and extending pigments in paint and paper.

Celite's physical structure itself is also utilized in many different ways . . . as the outstanding flattening agent for paints . . . as a mild non-scratching abrasive for fine polishes . . . and to improve surface appearance in plastics. And it is also the reason why Celite can add strength, toughness, stiffness, durability and many other desirable characteristics to your product.

If you want improved product per-

formance or lower production costs, investigate industry's most versatile mineral filler. One of the J-M Celite Engineers will gladly discuss your problem. These men are backed by complete technical services and the Johns-Manville Research Center, largest laboratory of its kind in the world.

For further information write Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay St., Toronto 1, Ont.



*Celite is Johns-Manville's registered Trade Mark for its diatomaceous silica products.



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Chemical treatments for cotton	144A
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New insecticide	150A
Paper sizing agent	150B
Spray-foam insulation	150C
Chromyl chloride	150D
Modified polyethylene	152A

New antibiotic	152B
Reinforced polyethylene tape	152C
Antibiotic pesticide spray	152D
"Heavy" polyethylene glycols	152E
Bleaching solution	152F
Acrolein dimer and derivatives	152G
Weed killers	152H

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ton. The resultant fiber possesses such properties as flame resistance, improved dye receptivity, resistance to rot and acids, water solubility and chemical reactivity.

There are surface treatments, too, but which are quite removed from the conventional processing in the past. Dyes, for instance, are used to impart not only color but flame resistance and water repellency. Deposition of polymers, or of monomers followed by polymerization, to and around the fibers makes cotton less apt to crease or burn.

Even mercerization boasts a newly-exploited twist—application without tension to produce a fiber with better elastic properties, kinkiness and clinging power.

And a process that falls somewhere between chemical and physical transformation is called cellulose decrystallization. Cotton thus altered is tougher, more receptive to these other chemical actions.

► **Slack-Mercerized Fabric**—A special method for shrinking—without tension—ordinary cotton gauze in strong caustic soda produces a cotton bandage of unusual elasticity and clinging power. Made in millions of units for the Armed Services and Civil Defense, this material is presently produced by four companies. One of these, Johnson and Johnson, New Brunswick, N. J., is reported marketing a general purpose, "medicine-chest" bandage to the public.

► **Tobacco Shade Cloth**—Lead chromate pigment, dispersed in an emulsified resin carrier, and deposited on cotton cloth, forms a

permanent screen for the sun's rays that cause deterioration. The product has a service life about three times that of untreated cloth, saves tobacco growers an estimated \$1 million a year. Production of shade cloth is up to 4 million yd. a year.*

► **Partial Acetylation**—Cotton may be converted to the acetate—by acetylation of about one-third the available OH groups—without loss of strength or fibrous form, by a solution of acetic anhydride and an acid catalyst in glacial acetic acid. First and foremost property of acetylated, or PA, cotton is its heat endurance. At 400 F. the strength of cotton yarn drops one-third in three minutes; PA cotton hangs on for 25 min. PA laundry press pad covers have four to five times the life of untreated cotton fabrics.

In mildew and rotting tests PA cotton retains 80-100% of its strength for more than 50 weeks.

*Two producers: Spartan Mills, Spartanburg, S. C.; and Whisfield Spinning Co., Dallas, Ga.

Cotton treated with copper additives lost 70% of its strength in 8-12 weeks.

PA cotton retains 67% of its strength after eight hours in 20% hydrochloric acid; cotton's loss is twice as great.

PA cotton, while it has been produced commercially, is not as secure as slack-mercerized and chromated cotton. Production has been rather uneven of late as the industry chooses to mark time and watch the outcome of the cyanoethylated cotton development program.

► **Cyanoethylation**—Interaction of cellulose and acrylonitrile yields a cotton that's more easily dyed, is more resistant to heat, rot and mildew—in fact, a product that appears very similar in end-use potential to PA cotton.

CN cotton, as it's called, will very probably be the next chemically-modified cotton to jump to the big time. The Institute of Textile Technology, at Rossville, Ga. and Southern Regional—with the big acrylonitrile makers, Monsanto and American Cyanamide, active behind the scenes—are putting CN production through its paces in the pilot plant stage. The Rossville, Ga., unit expects to turn out at least 20,000 lb. of CN cotton for major field evaluation by the middle of 1955.

► **Polymerization**—Permanent effects are obtained in cotton by applying monomers of the condensation type and then heating to cause polymerization. THPC monomer, tetrakis (hydroxymethyl) phosphonium chloride, used together with methylolmelamine, gives a cotton

For 1 lb. of Treated Cotton . . .

. . . This Much
for chemicals

Slack-mercerized	2¢
Shade cloth	2¢*
PA	33-43¢†
CM (insoluble)	3¢
(soluble)	9¢
THPC	22½¢
AM	10¢

*Added selling price, per yd., above that of untreated cloth

†Without chemical recovery

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- as a deactivator for insecticide carriers.
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Postcard inside the back cover.

that's flame resistant and not prone to rot or wrinkle. Several textile companies have made large samples of THPC cotton for evaluation.

Treating cotton with a vinyl-type monomer (essentially a bromoalkyl allyl phosphate) followed by heating in presence of a peroxide polymerizer, gives another flame resistant fabric called BA cotton.

► **Aminization**—Aminoethyl groups can be attached—in a degree represented by 0.7% N₂—to cotton cellulose with 2-aminoethyl sulfuric acid in the presence of sodium hydroxide to give AM cotton. This product accepts most dyes rapidly, is then often more resistant to light and laundering than similar products made by dyeing untreated cotton. Certain metals react with amino groups in AM cotton to form metal complexes having oxygen-exchange properties.

► **Carboxymethylation** — Monochloroacetic acid followed by strong sodium hydroxide does the trick here, can produce two distinct types of products—one insoluble in water, one not—depending on the degree of carboxymethylation. CM insoluble cotton has a built-in, starched effect and greater receptivity to crease-resistant treatments. CM soluble fabric—higher carboxymethylation—retains 80-100% of the tensile strength of the original yarn, is soluble in tap water and should be useful where a thread is needed temporarily.

► **Decrystallization**—Anhydrous liquid ethylamine reduces the crystalline cellulose in native cotton fiber to about 30% without harming the fiber. Its strongest argument for future use lies in its enhanced chemical reactivity which could make decrystallization a preliminary step to any of the other chemical transformations. 144A

Colloidal Silica

High purity, extreme fineness, low water content.

Cab-o-sil, a white and nearly chemically pure siliceous pigment, is prepared not by an aqueous precipitation but by vapor phase hydrolysis of a silicon compound in a hot gaseous system (1,100 C.). Low in water content (99.0-99.7% silicon dioxide) and very fine (0.015-0.020 microns), Cab-o-sil performs well as an agent for reinforcing, suspending, flattening, thickening, and as a transparent extender.

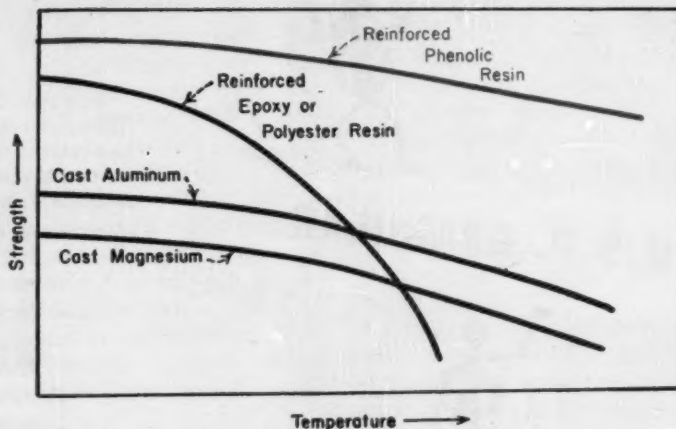
• **Reinforcing** — Rubber compounds with 22 parts Cab-o-sil to 100 parts natural rubber have ten-

sile strengths of more than 4,000 psi. High reinforcement also obtained with GRS, butyl and neoprene rubbers.

• **Thickening and gelling**—Following amounts of Cab-o-sil produce soft gels with the corresponding liquids: 12% in water, 11% in ethylene glycol, 9% in butanol, 8% in turpentine and 7% in benzene.

• **Anticaking** — Ten percent Cab-o-sil prevents DDT from caking; 0.4% does the same for sulfur.

• **Suspending**—Can stability of paints improved by use of 0.1-2% Cab-o-sil which retards the settling of high density pigments.—Godfrey L. Cabot, Inc., Boston 10, Mass. 148A



Reinforced Phenolic—Rigid and Strong at 500 F.

A new, glass-reinforced phenolic plastic boasts exceptional properties at 500 F.: tensile strength of 40,000-50,000 psi. and compressive strength of 30,000-35,000 psi. A temperature of 500 F. is far above the limits—about 300 F.—of glass laminated polyester and epoxy plastics, is even superior to the tolerances of aluminum and magnesium.

Resistant to corrosion and shock, this phenolic laminate has a greater strength-to-weight ratio than conventional metals. Weight savings can thus be passed on to mating or corollary structures.

And manufacturing techniques and tooling are much less costly for the high temperature-high strength plastic than for most analogous metal parts, especially those with complex shapes.

Most applications of the new engineering material have been in the aircraft industry, e.g. jet engine compressor blades. Its future, however, lies in any field where the advantages of reinforced plastic must hold up in the face of stiff temperature and strength requirements.—Curtiss-Wright Corp., Wood-Ridge, N. J. 148B

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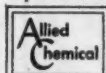
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CHEMICALS . . .

DDVP, A New Insecticide

Less toxic than other organic phosphorous insecticides, DDVP kills DDT-resistant insects.

Dimethyl dichloro vinyl phosphate, a member of a chemical family not previously considered a substitute for DDT-like compounds, is proving deadly to flies and insects with a natural or acquired resistance to DDT. By running contrary to form, this organic phosphate has perhaps opened up a new class of economic poisons.

Much safer for animal and man in general use than other organic phosphorus insecticides, DDVP is especially suitable, by virtue of its high volatility, for crops where insecticide residues are objectionable.

DDVP was produced from a commercial organic phosphorus compound by dehydrochlorination—a process which normally yields a relatively non-toxic substance. However, DDVP is ten times more potent than its parent compound. —Public Health Service, Savannah, Ga. 150A

Paper Sizing Agent

Alkylketene dimer gives hard sizing and alkali resistance.

Aquapel reacts with cellulose paper fibers to form the strong chemical bonds that yield hard and permanent sizing and resistance to water penetration. The size requires no alum, can be applied under acid or alkaline conditions. Aquapel-sized paper resists lactic acid solutions, alkaline solutions and other aqueous penetrants.

Properties of Aquapel-sized paper and some suggested end uses:

- Hard sizing—Dairy product containers, drinking cup stock.
- Sizing at high pH—Papers requiring permanence, non-corrosive papers, alkaline filled and coated papers.
- Alkali resistance—Soap wrap, reproduction paper, paper or board for use with silicate adhesives.
- Improved strength—Bag paper, boxboard.—Hercules Powder Co., Wilmington 99, Del. 150B



Spray-Foam Insulation

Covers irregular surfaces without fitting or fastening.

Sprayed like paint, self-adherent to wet and dry surfaces, Poly-Cell foams in place within minutes to give a thick, shaped insulation.

Special application equipment accurately blends two resinous liquids, then heats and sprays the thick mixture on to equipment surfaces. In a matter of minutes the applied coating begins to foam and swell. After fifteen minutes the foaming ceases, leaving a semi-rigid insulation up to 1½-in. thick.

A unique idea in industrial insulation, sprayable Poly-Cell has this outstanding advantage: The speed and ease with which even irregular surfaces can be insulated. The cutting, fitting and fastening required with other insulation is avoided. Poly-Cell is applicable wherever a spray gun can be pointed and sticks without need for adhesives.

Other savings will accrue from Poly-Cell's ability to be sprayed in exactly the amount needed—no more, no less. Some preformed insulations are not supplied in thicknesses of less than one inch.

The manufacturers believe a vapor or weather barrier can be applied directly to sprayed insulation without an intervening, supporting membrane and tack coat. Two reasons: the product's structural strength; a one piece insulation, it has no joints to expand or contract.

K factor for Poly-Cell insulation

is 24 (per inch of thickness and density of 2 lb. per cu. ft.) Temperature range: 225 F. to -40 F. Coverage: 1 gal. of Poly-Cell liquid mix when sprayed over 100 sq. ft. foams to a thickness of ½-in.—Insul-Mastic Corp. of America, Pittsburgh 22, Pa. 150C

Chromyl Chloride

Compatible with organic solvents, it acts as an oxidizing and a chlorinating agent.

Moving out of laboratory bottles and into 200 lb. drums is chromyl chloride, perhaps the only chrome chemical available in quantity that's miscible with non-polar organic solvents. Add to this a not unattractive current price—based on pilot plant production—of 70¢ a lb., and you have a chemical with interesting possibilities.

• Chemically, chromyl chloride performs as a vigorous oxidizing and chlorinating agent. It's a valuable reagent for converting to an aldehyde a methyl group attached to an aromatic nucleus. It yields chlorinated ketones in reactions with aliphatic hydrocarbons. Chromyl chloride's volatility tags it for use in vapor phase reaction with CO₂ or N₂ as vapor carriers.

• Functioning as an acid chloride, this chrome chemical hydrolyzes easily first to chromic acid and hydrogen chloride and then further to chlorine and chromic chloride. Production of organic chromates from oxidation resistant molecules is an interesting possibility.

• Because chromyl chloride is compatible with organic solvents it can be useful in preparing trivalent chromium complexes soluble in organic liquids and soluble in water. Examples: chromic chloride

For More Information . . .



about any item in this department, circle its code number on the Reader Service

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TF

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Two men got together in 1912

They had probably looked a little farther into the future of piping practice than other engineers of their time . . . these men who met in the Spring of 1912. One was the late J. Hall Taylor, founder of Taylor Forge. The other was Charles Van Stone whose name was to go into most engineering handbooks as an engineering designation.

They were relatively young men, but they were old in piping knowledge and experience. Both had watched pressures rise from the old 100 lb. level to 125 lbs., and now it was pushing 150! For these mounting pressures Charlie Van Stone had questioned threaded fittings. Seeking something better, he had worked out his method of slipping flanges over pipe ends, then flaring out the ends and facing them so that the pipe-ends would make a good gasketed seal when the flanges behind the lapped ends were tightly drawn together by bolts.

The result was a strong, leak-tight joint . . . well attested by its acceptance ever since as the "Van Stone joint." But in 1912 it had a fault that Charlie Van Stone wanted to correct. He had been forced to use cast iron flanges. When the bolts were pulled up, the cast flanges, being brittle, often cracked. Van Stone had heard that this was the same trouble Taylor had encountered and overcome by developing strong, ductile flanges of forged steel.

He had heard correctly: within a few months Taylor Forge was producing a forged steel flange that was to make the Van Stone joint equal to any pressure then or in the years ahead. In its modern version—the Taylor Forge lap joint—it is one of the most effective connections for pressure piping.

It was this meeting that marked the transition of Taylor Forge from a small forge shop making flanges for our own consumption to maintained leadership in the forged flange field. In 1912 Charles Van Stone did not know that his name would become an engineering term, and J. Hall Taylor did not know that he was shaping the course of designed piping progress.

An episode in the story of
Taylor Forge leadership in designed piping

CHEMICALS . . .

complexes with stearic, methacrylic and fluoro-fatty acids having unusual water-proofing and oil repellent properties; and a group of chromium-metallized dyes and chelate derivatives like chromic acetylacetonate.

• Chromyl chloride dissolves chromic anhydride in substantial amounts. These solutions are vigorous oxidizing agents, causing ignition of hydrocarbons, alcohols and amines.

Reactive chemical though it is, chromyl chloride in its present purified form (98% CrO_2Cl_2 with small amounts to Cl_2 and SO_2) is stable when protected from light and moisture and can be stored with negligible corrosion in steel containers.—Mutual Chemical Co. of America, Baltimore 31, Md. 150D

Modified Polyethylene

Polymer-elastomer blends give better coatings for wire, paper.

Mixing polyethylene with elastomer materials, while it may decrease the polymer's chemical resistance and strength properties, yields a product superior to the straight polyethylene for many purposes.

Paper coated with new Ladcote modified polyethylenes is more resistant to water vapor transmission, less apt to crack and adheres better to webs.

Wire coated with Ladcote polyethylene is said to have greatly improved resistance to stress cracking and to be especially useful for low-loss insulation in high frequency work.

Molded articles of modified polyethylene are more flexible, and softer than those made from the unmodified base resin. Tubing made from polyethylene-elastomer combinations is used widely as a component of aerosol containers.

The original Ladcotes, on which the newer formulations are based, are combinations of high molecular weight polyethylene with waxes, resins and/or elastomers and have found favor in the paper coating industry.—L. A. Dreyfus Co., South Plainfield, N. J. 152A

Briefs

Cycloserine, a new antibiotic, has been found to be exceptionally potent against advanced tuberculosis and infections of the genitourinary tract. Contrary to other successful antibiotics, cycloserine is much more active in the human body than in the test tube, a discovery likely to cause many a drug maker to wonder about the countless antibiotics shelved in the past because of low potency in the test tube.—Commercial Solvents Corp., New York 16, N. Y. and Eli Lilly and Co., Indianapolis, Ind. 152B

Glass-reinforced polyethylene tapes are offered for industry evaluation. Called No. 875 (pressure sensitive) and No. 877, these tapes were originally developed to reinforce plastic panels for government weather balloons. No. 875 has a tensile strength of 150 psi. per inch of tape width; No. 877, 100 psi. per inch of tape width. Their only other specific applications at present are: edge reinforcement in woven wire and silk screen industry; reinforcement for light weight plastic tarpaulins.—Minnesota Mining and Mfg. Co., St. Paul 6, Minn. 152C

A spray combination of terramycin and streptomycin, called Agri-mycin, boosted tomato yields by 154 bushels per acre and pepper yields as much as 67% by controlling a crop disease known as bacterial spot. Three years of field testing by the U.S.D.A., land grant colleges and State Dept. of Agriculture stations have demonstrated Agri-mycin's effectiveness against such plant plagues as apple and pear fire blight, soft rot of potatoes, blue mold and wildfire of tobacco.—Chas. Pfizer & Co., Inc., Brooklyn, N. Y. 152D

High molecular weight polyethylene glycol—15,000 to 20,000—is Carbowax 20M, a water-soluble, white solid. 20M's melt viscosity and aqueous solution vis-

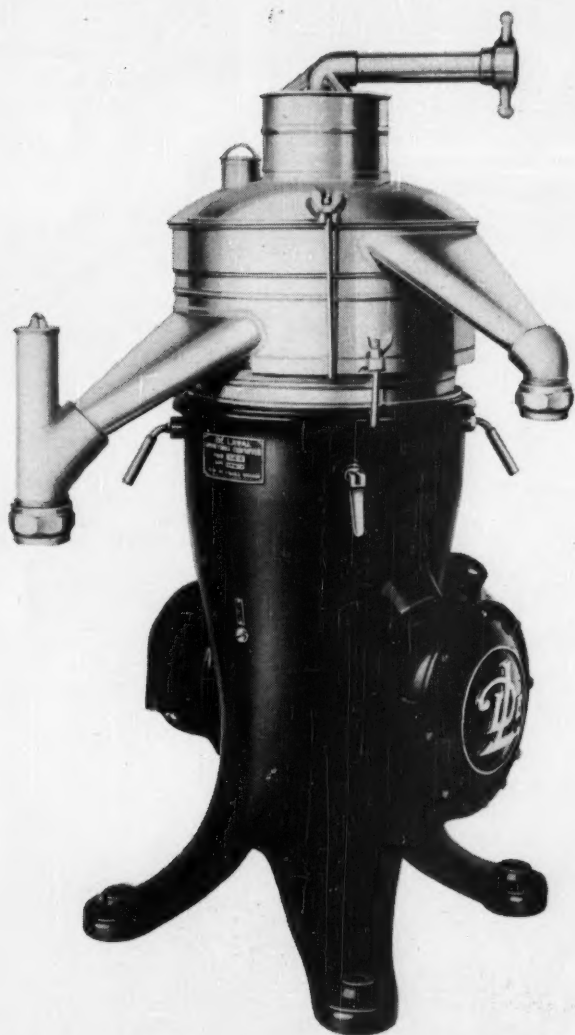
cosity are higher than those of Carbowax 6000, the heaviest polymer previously available. Films formed with 20M are stronger and harder than those of other solid polyethylene glycols. 20M's solution viscosity is twice that of equivalent gum arabic solutions.—Carbide and Carbon Chemicals Co., New York 17, N. Y. 152E

A bleaching solution said to completely eliminate yellowing is expected to solve a major defect in Japanese synthetic textiles. Amino naphtha acetylide can be mass produced at low cost permitting Japan to suspend imports of bleaches.—Tokyo Institute of Technology, Tokyo, Japan. 152F

Acrolein dimer and three of its derivatives are available in quantity. Acrolein dimer is starting material for preparation of synthetic resins and the synthesis of chemicals for textile finishing, paper treating, rubber compounding, pharmaceutical and plasticizer manufacture. The derivatives: alpha-hydroxyadipaldehyde is an insolubilizing agent for protein and polyhydroxy materials and a cross-linking agent for polyvinyl acetal and polyvinyl acetate; hexanetriol-1,2,6 is an alkyd and polyester resin intermediate, a softener and solvent; tetrahydropyran-2-methanol has utility in the preparation of plasticizers and pharmaceuticals.—Carbide and Carbon Chemicals Co., New York 17, N. Y. 152G

Two weed killers, alpha-chloro-N, N-diallylacetamide and -N, N-diethylacetamide, give good grass control—giant foxtail, crabgrass, broadleaf weeds, and others—at rates of 3-6 lb. per acre. Although tested in 2,700 widely scattered plots with good results, the alpha-chloroacetamides will need another year of cooperative field trials before sale will be permitted.—Monsanto Chemical Co., St. Louis 4, Mo. 152H

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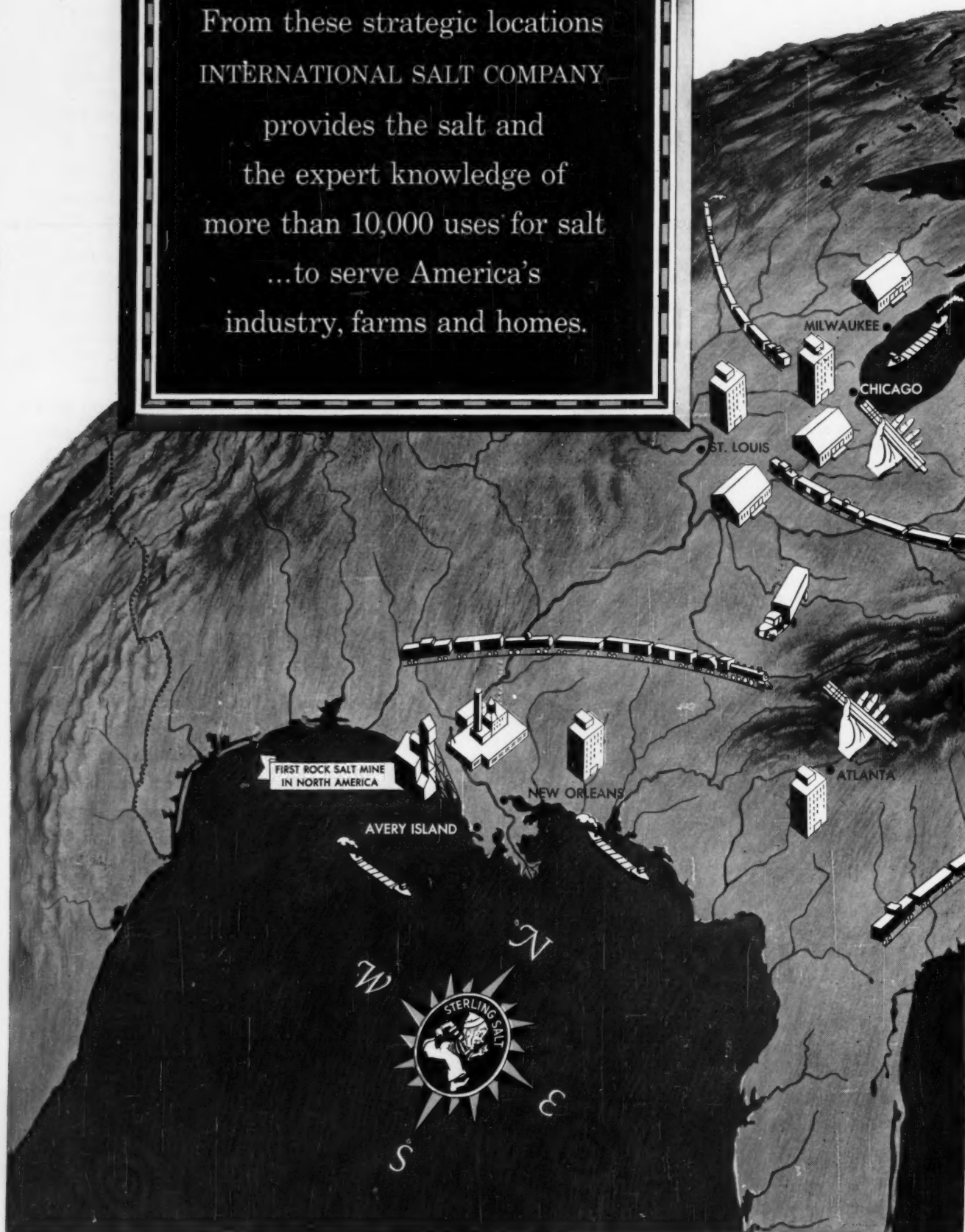


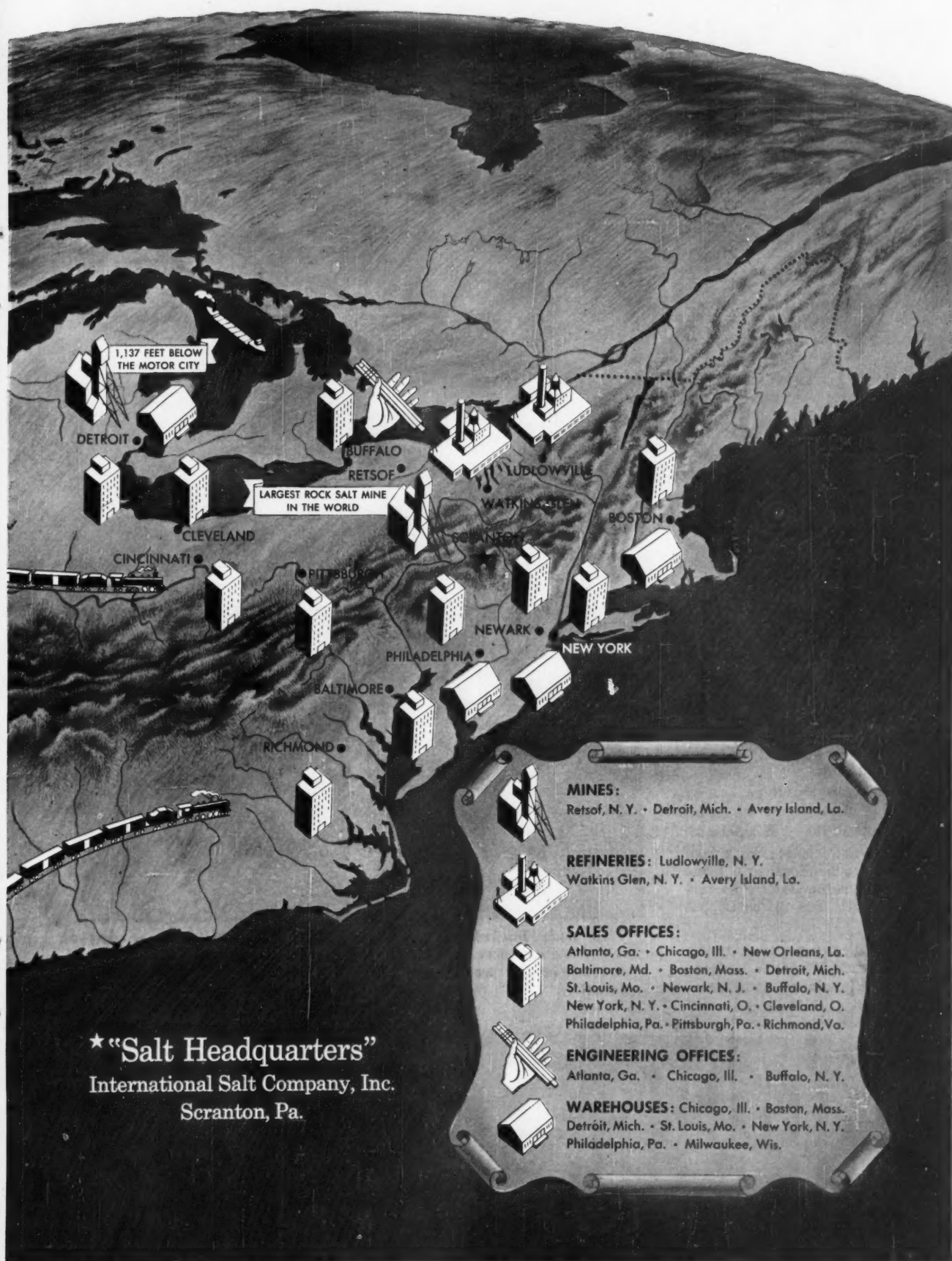
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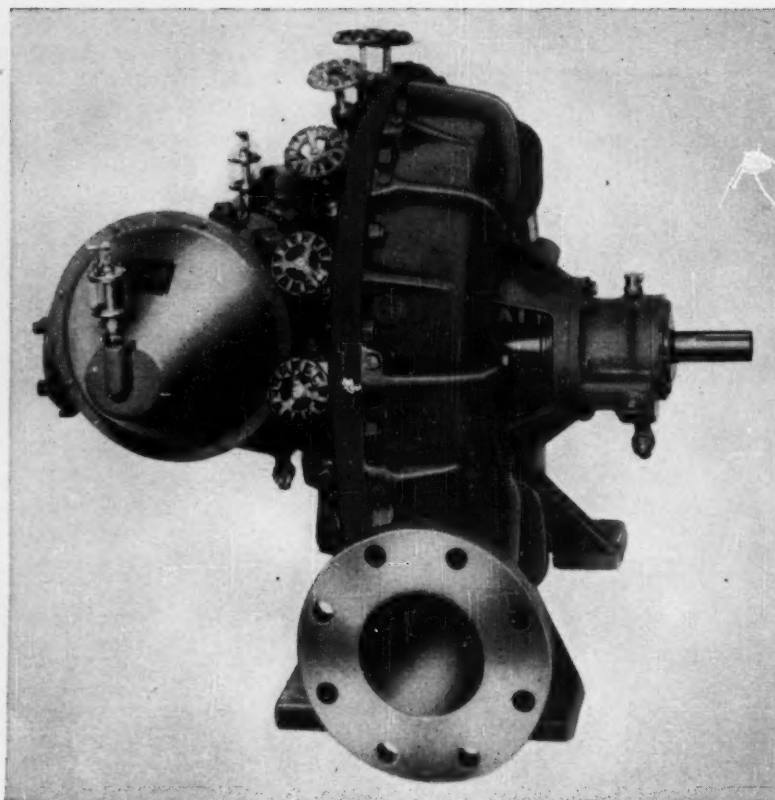
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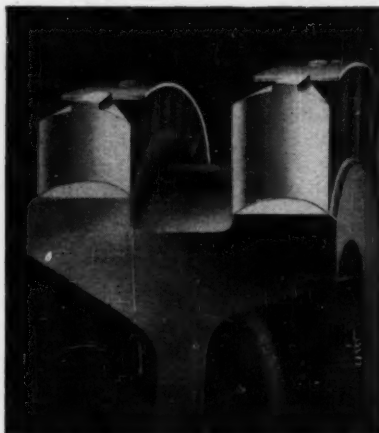
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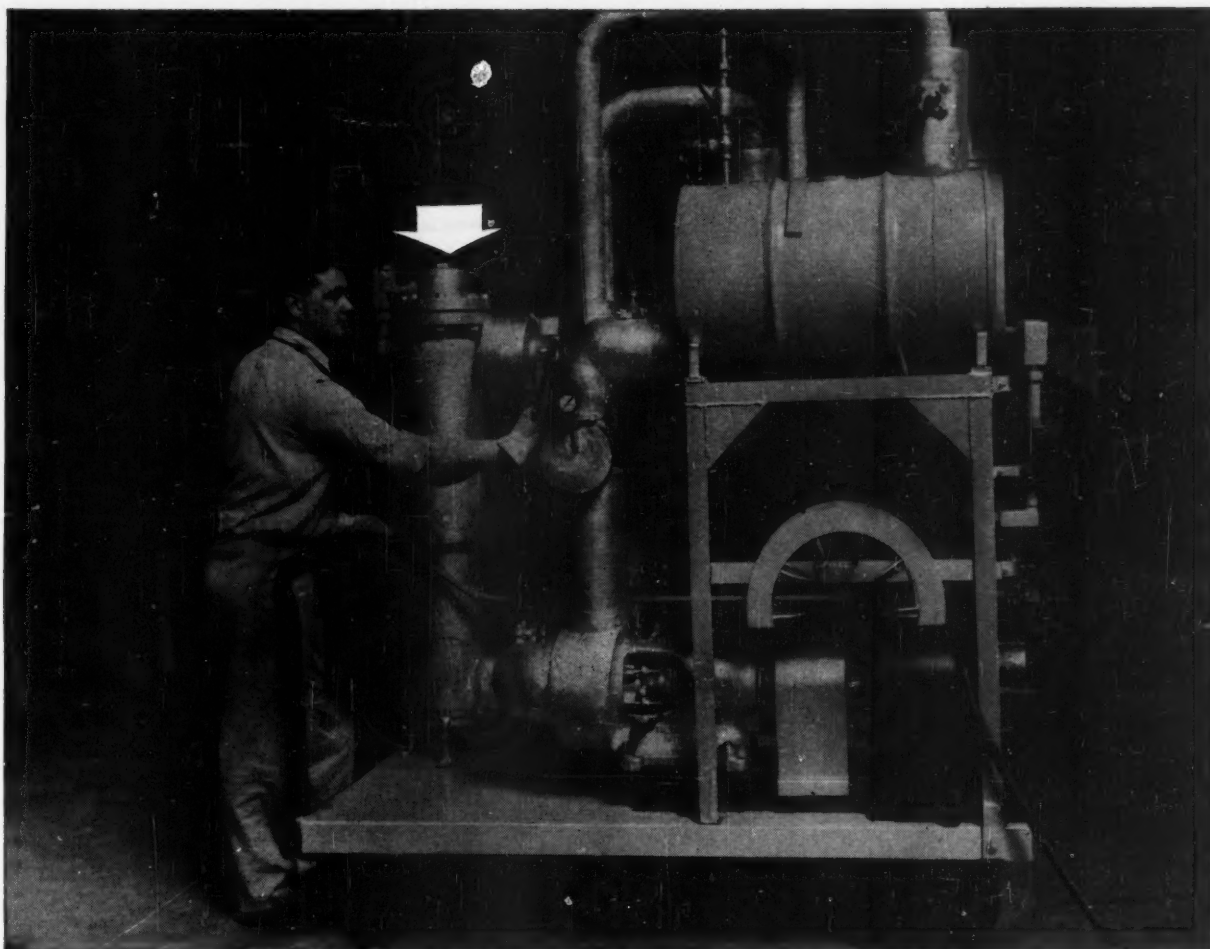


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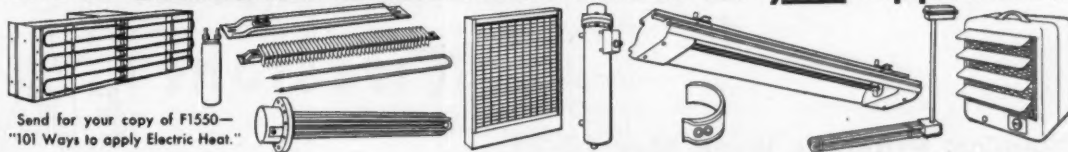
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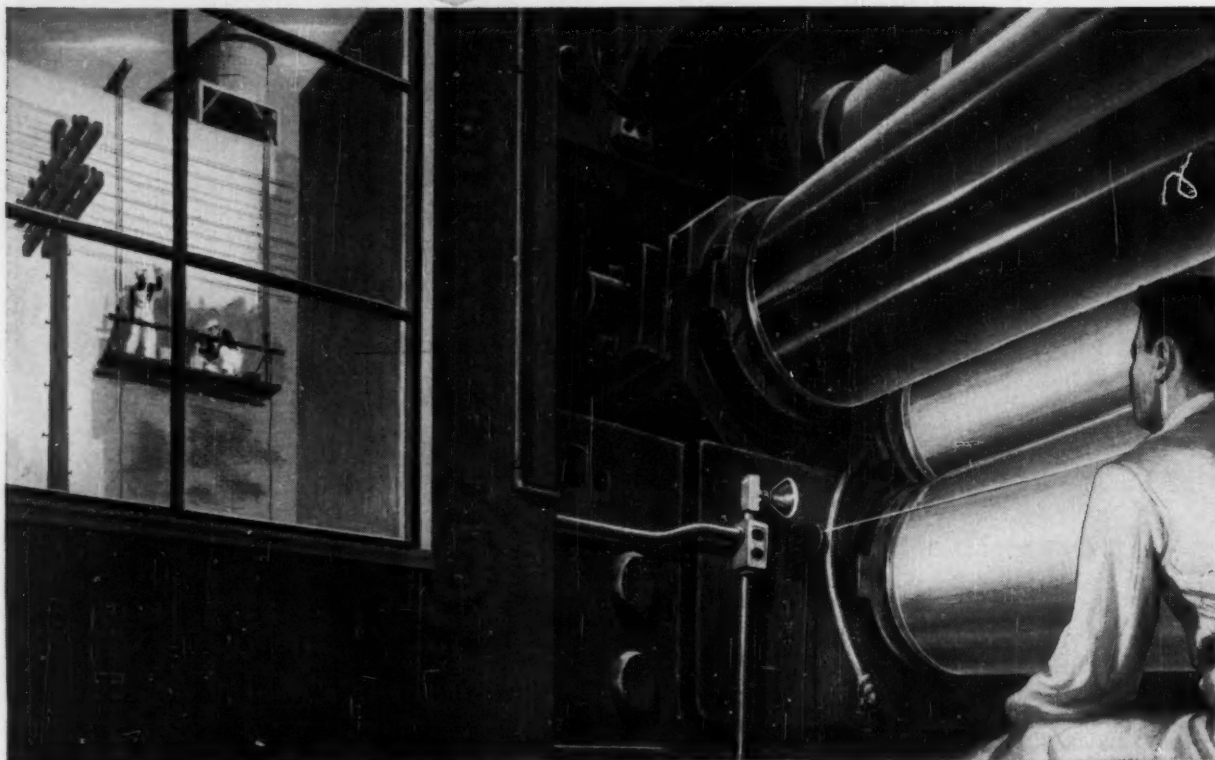


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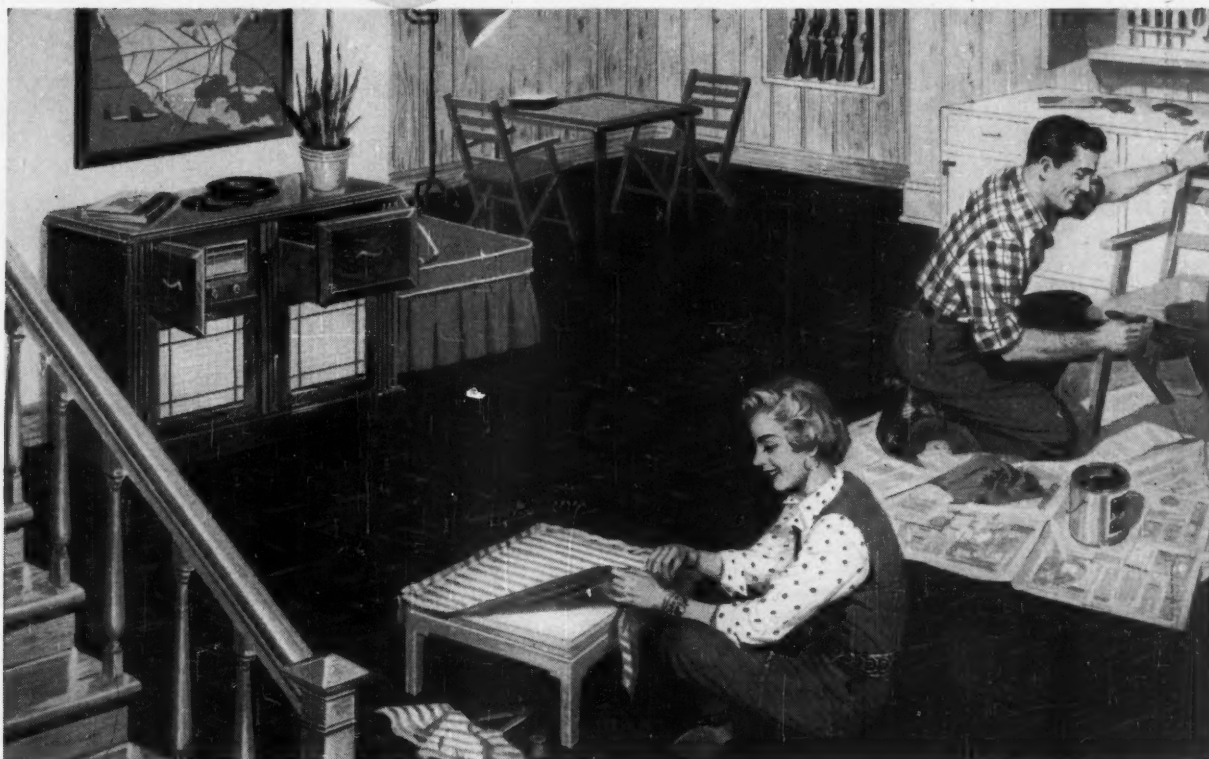
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High bulking density and easy processing at low temperatures. Compatible with extender resins.

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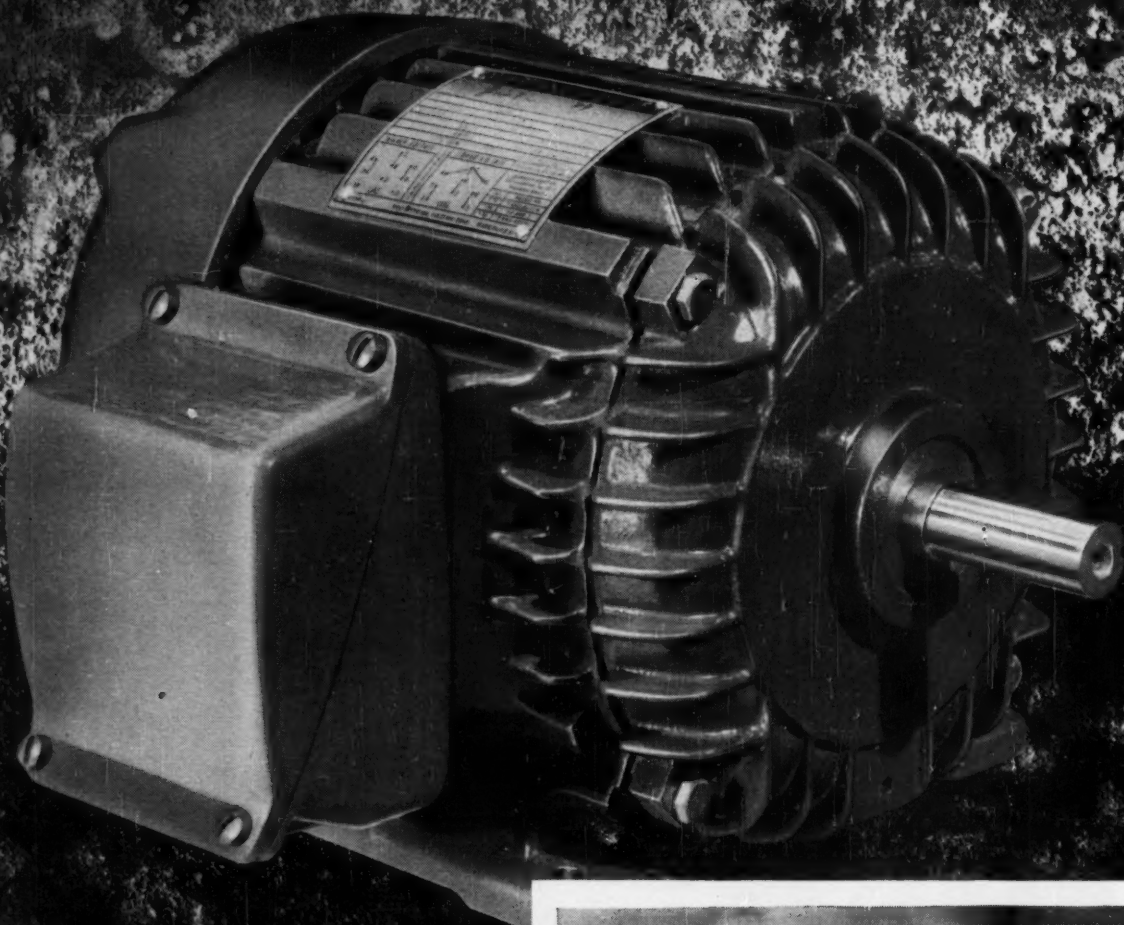
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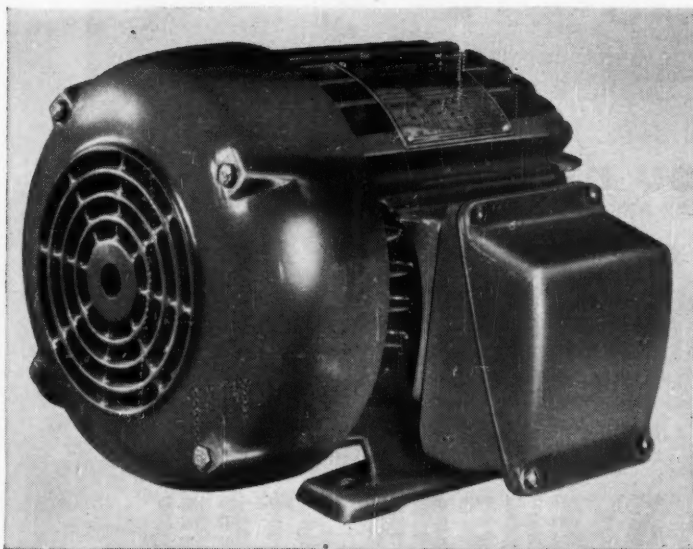
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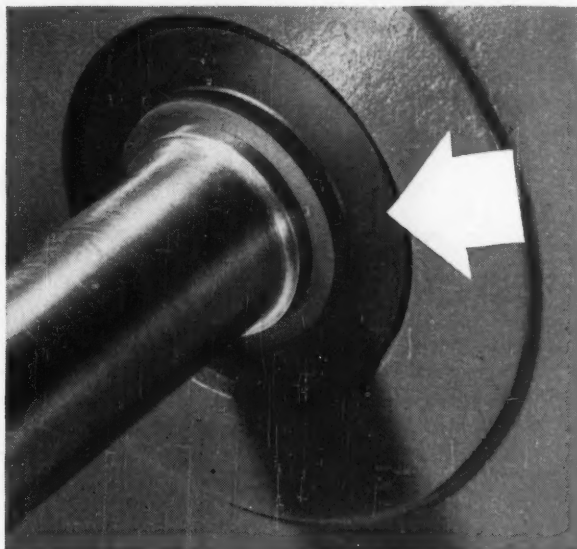
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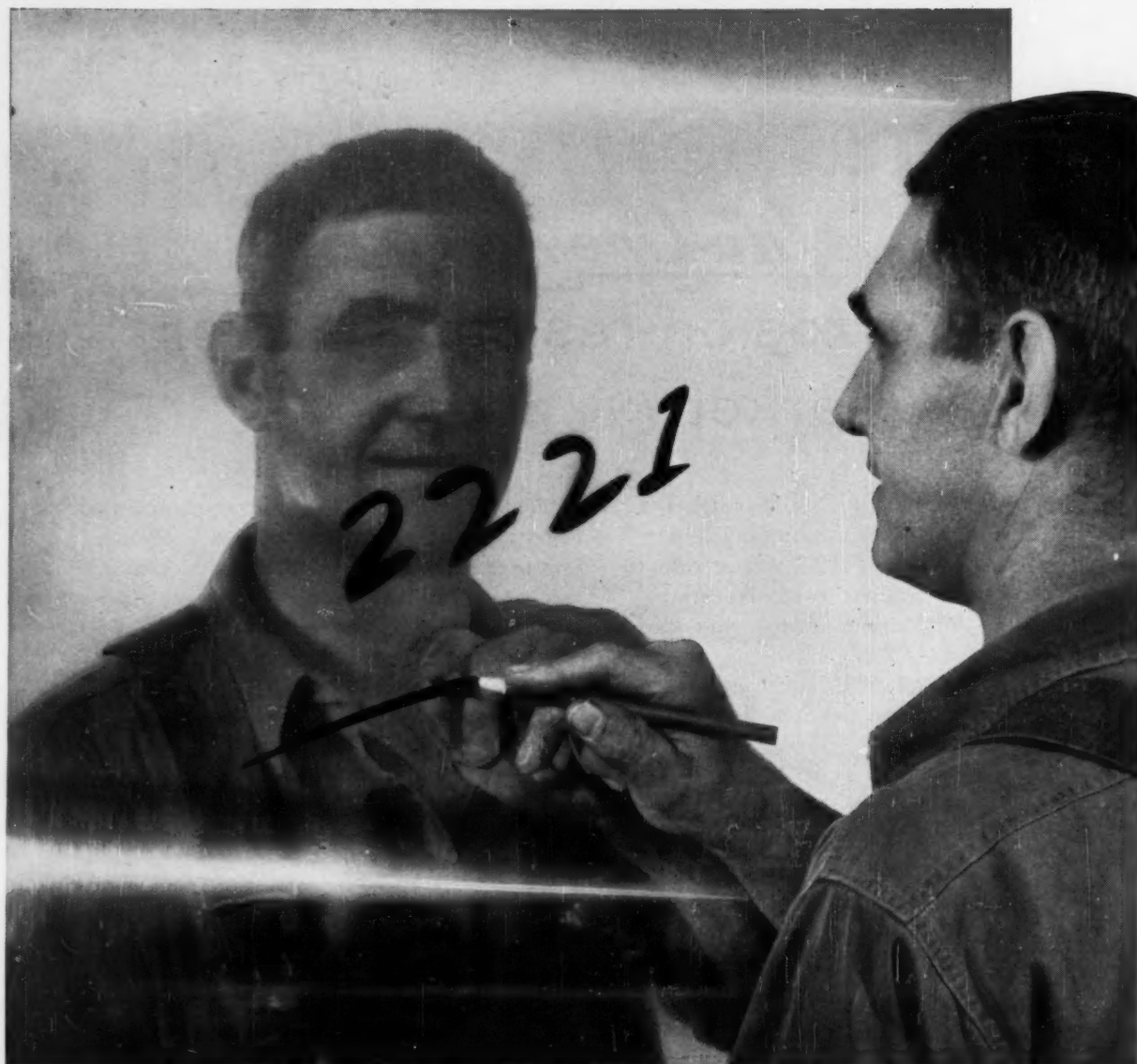
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Mechanical System Fact—New cast-iron frames and brackets utilize the finest grained castings with uniformly thick wall sections precisely fitted and sealed. Molded glass plastic cooling fans on totally-enclosed types are chemically inert.



Lubrication System Fact—The new pre-lubricated Life-Line "A" bearing features a "4-way seal"—*two* seals on each side. Totally-enclosed types have additional neoprene flinger which assures bearing protection in any corrosive application.



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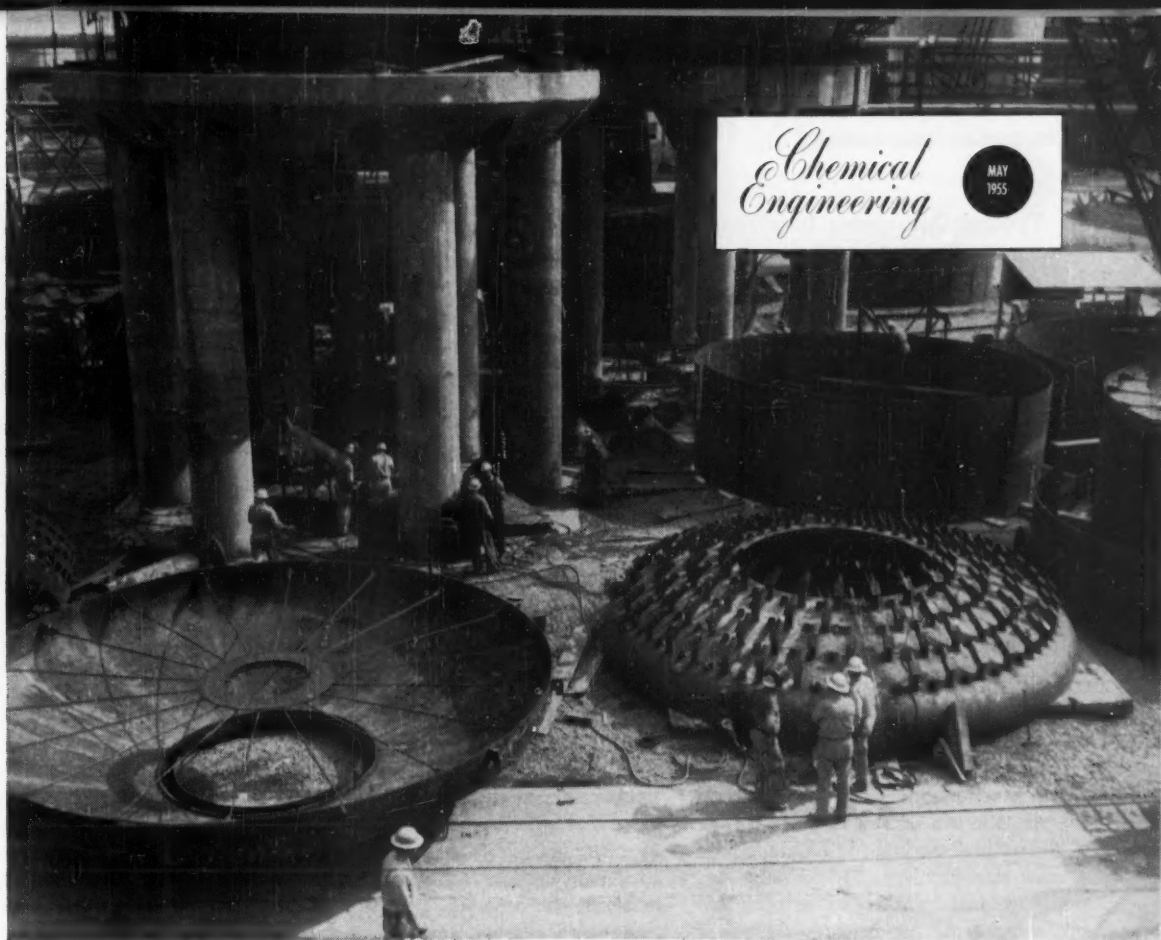
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Solids-Gas Contacting

New techniques will prove invaluable to all engineers in chemical, metallurgical and petrochemical operations.

RAYMOND E. VENER and LEWIS A. ROBINSON
Catalytic Construction Co., Philadelphia, Pa.

PROCESSES that involve the contact of gases with solids are among the most widely encountered in the chemical, metallurgical and petroleum industries. Many instances of new or improved techniques have been developed within these industries. Notable are those in petroleum cracking and refining, the development of moving-bed and fluidized-solids methods.

Substantial progress has also been made in the development of more efficient solids-gas contacting equipment in the ferrous and non-ferrous industries, atomic energy operations, and chemical fields such as

heavy inorganic chemicals, dyestuffs, pulp and paper, cement and plastics.

Unfortunately, in spite of engineering advances made in these industries, only in recent years has there been any major progress in translating processing techniques from one industry to another.

A survey of the many operations in use today shows that there is considerable inertia and reluctance on the part of many industries to study objectively the relative merits of all alternate techniques. We hope that this report may stimulate such systematic comparisons and perhaps provide a very preliminary basis

Typical Operations Involving the Contacting of Gases and Solids and the Factors Involved

Operation	Industries	Typical Important Factors Involved
Catalytic cracking.....	Petroleum.....	Chemical kinetics, heat transfer, catalyst properties, flow rates of catalyst and gases, temperature level and control, degree of conversion, catalyst activity.
Reactions of gases catalyzed by solids ...	Chemical, petroleum.	Chemical kinetics, heat transfer, capacities involved, catalyst activity.
Drying or solvent removal.....	Chemical, metallurgical, petroleum.	Diffusion in gas and solids, capillarity, gravity, heat transfer, capacities, temperature sensitivity of solids, solvent recovery.
Oxidation.....	Chemical, metallurgical.	Chemical kinetics, diffusion, heat transfer, temperature control.
Reduction, halogenation, sulfatization, and other chemical conversions of solids	Chemical, metallurgical.	Chemical kinetics, diffusion, heat transfer, degree of conversion.
Heat transfer.	Practically all.....	Method of heat transfer—direct or indirect, types of fluids and surfaces, etc.
Thermal decomposition of solids, hydrates, carbonates and nitrates	Chemical, metallurgical, petroleum	Diffusion in solid and gas, heat transfer.
Adsorption	Chemical, petroleum...	Diffusion, activity and surface area of solid.

for such comparative evaluations.

In our use of the term "solids-gas contacting" we intend to include processes that involve:

- Heat transfer
- Mass transfer
- Chemical conversions or reactions of solids and gases
- Various combinations of the above

The table above illustrates typical operations involving the contacting of solids and gases and some of the typical factors that are involved. Our definition of solids-gas contacting does not include size reduction or classification of solids, cyclones, gas filters or scrubbers, nor the flow of gases through conduits. These operations can be more appropriately grouped into categories such as mechanical separations, materials handling and fluid mechanics.

Substantial improvements in mechanical designs and thermal efficiencies have been achieved over the past several decades for rotary kilns, drum dryers, continuous conveyor drying systems, spray calciners and other equipment involving some form of solids-gas contacting. The technical and economic advantages accompanying these developments have resulted in new applications to other fields of chemical industry.

Thus, the development of the spray or prilling method for producing discrete spherical particles of ammonium nitrate, amenable to simple non-caking

treatment, together with the use of new spray atomizers for a large variety of other materials has lead to the adoption of this technique for new uses in the organic and inorganic chemical fields.

These include the drying of solutions, slurries and pastes as well as coolants and crystallizers for molten materials. An investigation of the pertinent mechanisms for these applications indicates the importance of solids-gas contacting. It is probable that future investigations will show that many other materials can be treated to furnish a feed suitable for spraying or atomizing.

Conversely, many operations currently conducted by the spray method might profitably be converted to other methods. Drying or decomposition of materials such as hydrates of inorganic salts can also be carried out in numerous ways including rotary dryers, spray units, fluidized and moving beds, continuous tray drying, etc. The method of feed preparation, the type of product obtained and other necessary accessory operations will usually differ and have an important bearing on the cost of alternate methods.

Two of the most efficient and important methods of solids-gas contacting, the moving-bed and fluidized-solids techniques, originated in research and development by the petroleum industry. These methods are an outgrowth of the aim of the oil industry to achieve more efficient use of the

heavier petroleum components in crude oil through catalytic cracking processes.

The catalytic cracking process involves two essential operations: an endothermic reaction for decomposition of heavy to lighter hydrocarbon products; and an exothermic oxidation of the non-volatile hydrocarbons retained on the catalysts during cracking. Both are solids-gas contacting operations involving heat transfer, mass transfer and chemical conversion of gases.

The evolution of moving-bed and fluidized-solids methods—from the original Houdry fixed-bed process through the Thermoform, Houdriform and other developments—constitute truly remarkable engineering achievements. This is particularly true since they were accomplished over a short span of a few years.

The tools developed in this field have proved invaluable for other applications in the petroleum industry, shale retorting, separation of gases by activated carbon, drying of gases and heat exchange in pebble heaters. There have been numerous publications on possible applications of the fluidized-solids technique to nonpetroleum fields. However, relatively little attention has been directed to the potential value of the moving-bed technique outside of the petroleum industry.*

A comprehensive review of all the

*More about this in an early issue.

commercial applications and suggested innovations for conducting operations involving solids-gas contacting would be very long and beyond the scope of this report. As pictorial proof of the complexity in the field of solids-gas contacting, we have shown (right) the interrelationships between operations performed and equipment used.

Innumerable schemes have been designed to accomplish solids-gas contacting. Many of them are now either outmoded or designed for very specific applications. Certainly there is no single technique known that is a universally optimum method or even generally suited for all purposes.

The tremendous range of operations encompassed in solids-gas contacting is so broad that undoubtedly there will always be a need not only for many of the existing operations but also for continued research and development aimed at new approaches.

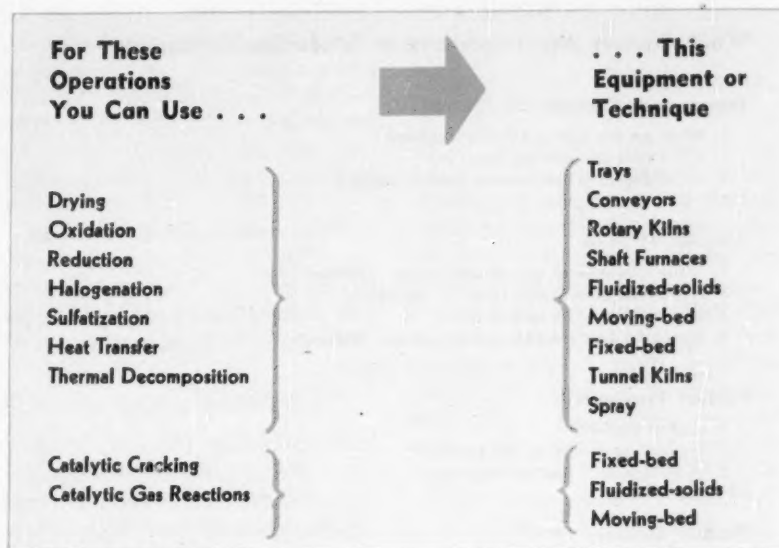
By emphasizing basic points of similarity of diverse commercial operations such as drying, calcining and catalytic cracking, we hope that this report will stimulate further work on new approaches as well as objective studies of alternate existing methods.

Not a New Unit Operation

The concept of classifying various operations of the chemical industry into a series of integrated unit operations was first proposed by Walker, Lewis and McAdams in their pioneering textbook (1923). Subsequently the definition of chemical engineering accepted by the American Institute of Chemical Engineers specified that:

"Chemical engineering is that branch of engineering concerned with the development and application of manufacturing processes in which chemical or certain physical changes of materials are involved. These processes may usually be resolved into a coordinated series of unit physical operations and chemical processes."

The resulting trend has been to expand the categories of unit operations, as indicated by each new textbook and literature review of the subject. Many developments such as fluidized-solids, ion exchange, leaching, dialysis, moving-bed, etc., have been hailed as new chemical engineering unit operations. The same is true of



unit processes. This is illustrated by the ever-increasing number of such processes covered by periodic literature reviews.

This type of unit classification, while of tremendous value in the past in establishing a systematic and orderly procedure for the engineering of chemical plants, has reached a point of diminishing returns.

The difficulty and complexity of treating unit operations and unit processes as a series of essentially separate entities—often with separate and specialized theory and nomenclature—is reflected in academic curricula throughout the country. Colleges are pressed to include more and more of these operations and processes in lecture and laboratory courses.

It is inevitable that we will have to consider redefining the scope and fields of chemical engineering. The present definition leaves much to be desired. We suggest that a logical approach would be either to group most of the so-called separate unit operations into a few new categories or to undertake a completely new and fundamental approach to the field of chemical engineering.

Some progress has been made by including operations such as absorption, extraction, humidification, etc., under the category of "diffusional operations," with a general fundamental or theoretical treatment for the group.

It seems logical to consider the subject of solids-gas contacting as a broad

unit operation with the various applications and techniques as subdivisions. Therefore, a new development such as the moving-bed or fluidized-solids method should not be considered as a new unit operation. They are new mechanisms or tools for accomplishing a reaction. To illustrate the need for such a reclassification let us cite the fact that most operations that involve solids-gas contacting involve chemical as well as physical changes.

Contacting Operations

Essentially all of the unit operations consist of the contacting of two or more phases and involve fluid mechanics, heat or mass transfer. However, the relative importance of pertinent factors varies considerably with the specific application involving various combinations of gases, solids and liquids.

Although, strictly speaking, equipment such as air classifiers, absorbers and cyclone dust separators involve the contacting of solids and gas, their prime purpose is basically different from the equipment that we will discuss.

When chemical kinetics is a factor in addition to heat and mass transfer, the number of potentially important rate-controlling mechanisms increases tremendously. For instance, although diffusional phenomena are practically always involved when mass transfer occurs, the actual limiting factor in

What Factors Are Important in Solids-Gas Contacting?

Temperature Control

1. What are the heat quantities involved?
2. Is the solid temperature sensitive?
3. Is the degree of temperature control critical?

Function of Solid

1. Is the solid present only to catalyze gas reaction?
2. Is the solid present only to act as adsorbent?
3. Does solid function only as filter?
4. Does solid function only as heat transfer medium?

Product Properties

1. Cost of product?
2. Product specifications and purities?
3. Is uniformity of product important?

Product Recovery

1. Is dusting from the unit a problem because of health, safety or radiation hazards?
2. Relative ease of dust recovery?
3. Is the gaseous effluent processed for recovery of products or better heat utilization?

Feed Properties

1. Is feed preparation necessary?
2. What are the surface area requirements of reacting solid?
3. Is there a tendency towards agglomeration?
4. Are the feed materials of a corrosive nature?

General Considerations

1. What capacities are involved?
2. Are countercurrent flow and uniform driving force important?
3. Are the operations flexible enough?
4. What is the total pressure required and what are the pressure drops involved?
5. Is there a need for sweep gases?
6. Is this a steady-state or batch operation?
7. Is the retention time important?

many instances is the rate of chemical reaction.

In the table above we give a checklist of general factors that may be important in a given operation (not necessarily in any order of importance). An objective and comprehensive evaluation of these factors is necessary to permit the proper selection of an optimum scheme or the substitution of a new or improved technique for an existing process.

Solids-gas contacting operations include such varied reactions as:

- Thermal decompositions of solids to form other solid products and gases.

- Reactions between solids and gases to either a solid or gaseous product or both.

- Reactions where the solid functions as a catalyst to influence the rate of reaction. It may form an intermediate compound but it is not one of the original reactants or final products.

- Use of contacting equipment for solids and gases as a heat transfer mechanism.

Drying

There is a very large variety of equipment in commercial use for drying of solids. (Drying is defined here as the removal by thermal means of water or other liquids from solids, pastes or slurries.) This variation in equipment is largely due to differences in commercial materials of physical

and chemical properties, physical form, product specifications, thermal stability, corrosion characteristics, scale of operation and method of heat transfer.

One of the difficulties in trying to incorporate new developments into this field is the general tendency to treat drying operations not as a science but as a traditional art, characteristic of a particular industry. In terms of variety of equipment used, tonnage of materials processed and money invested, drying is probably the most important of the operations discussed here.

A comprehensive review of commercial drying practice would be very lengthy. Excellent practical coverages of the subject are available in the "Chemical Engineers' Handbook" (3rd Ed.) and *Chem. & Met.*, May 1942, p. 93.

In the drying of solids the two major mechanisms involved consist of heat transfer to evaporate the liquid and mass transfer of vapor and/or liquid from the solids into the gas stream. Often there is one more factor: the chemical change in the solid phase which may determine the rate.

Here is one classification of dryers based on heat transfer methods:

DRYERS

Direct

Continuous

Batch

Indirect

Continuous

Batch

Radiant or Dielectric

An alternate scheme of classification involves the variation of physical properties and handling characteristics of wet feed and dry product.

Neither these nor any other classification scheme that has been proposed appear to be completely satisfactory; mainly because of the tremendous diversity of equipment, the overlapping of many categories and the omission of possible alternate methods that might be used.

Although practically all experimental drying studies have used water as the liquid, major decisions on engineering design are rarely based on fundamental considerations of the diffusion of liquid and vapor within the solid interstices, capillarity, shrinkage, pressure and gravity gradient. These mechanisms are often the sub-

ject of conjecture in the evaluation of operating data. But actual plant design and operating procedure are almost always based on empirical data and experience (taking into consideration such factors as temperature sensitivity, feed and product specifications and gas conditions).

Assuming the technical feasibility of conducting a drying operation in various types of equipment, the logical choice should be based on a thorough comparison of investment and operating costs. Selection should always include some consideration of the steps preceding and following the drying, especially insofar as they affect the over-all cost.

Quite often the evaporation step preceding the final drying can be simplified by appropriate dryer selection. Substantial progress has been made in recent years in the use of new solids-gas contacting developments for drying operations and in the use of bench-scale data for the prediction of performance of large equipment.

Adsorption

There has been increasing interest in the removal of relatively small amounts of materials from gases by adsorption on solids.

Adsorption phenomena are generally divided into two distinct categories depending on whether the association between gas and solid interface is physical or chemical. Physical association is most common and results from attraction due to van der Waals or dispersion forces. This type of adsorption is typified by such gases as SO_2 , CO_2 , Cl_2 , CO and CH_4 on charcoal. The more easily liquefied gases are the most easily adsorbed. Heats of adsorption are approximately 10 kg.-cal./mole.

Adsorption, characterized by chemical association of the solid and gas is called activated adsorption or chemisorption. It is accompanied by relatively large heats of reaction, 20-100 kg.-cal./mole. The rate of adsorption is usually low and the reaction is often irreversible. Examples are the adsorption of hydrogen on nickel and of oxygen on carbon.

A number of solids-gas contacting methods should be well suited for adsorption. Much work has been done

on the development of continuous adsorption and desorption. This work includes the use of moving-bed and fluidized-solids techniques. These two methods are especially well suited for adsorption operations with heat addition and removal for the required reactions.

In view of these new improved tools for handling large quantities of adsorbed gases, many new uses can be expected in the chemical industry that involve adsorption of gases on solids.

Catalytic Organic Reactions

The importance of new or improved solids-gas contacting methods for heterogeneous catalysis operations lies primarily in the need for adequate temperature control of the reactor. Among the methods used commercially outside of the petroleum industry are:

- Moving-bed, fluidized-solids and fixed-bed methods discussed previously for petroleum uses.
- Addition of inert sweep or carrier gases.
- Injection of reactants at various points in the reactor.

Considerable work remains to be done in the design of equipment and reactors that will permit the control of optimum conditions for continuous catalytic conversions of gases. In spite of the substantial fundamental theory and data available, the mechanisms involved are so complex and the difficulty of establishing the rate-determining factor is so critical, that practically all commercial design is now based on empirical methods.

Heat Transfer

One of the most interesting developments in the use of solids-gas contacting methods involves the moving-bed and/or fluidized-solids techniques to store and transfer heat from one process vessel to another. This takes advantage of the high heat capacity characteristics of solids.

Pebble heaters (which are moving-bed units) were developed during World War II for superheating steam to higher temperature than possible in normal steam generators. Pebble heaters are also well suited for heating industrial or reactant gases for various operations. The maximum tempera-

ture is limited only by the characteristics of the solids used.

Thermal Decomposition

The mechanisms involved in the decomposition of hydrates or sulfates of inorganic compounds and the calcining of metal carbonates to the oxides are quite similar to that described for drying.

Accordingly, we can expect that much the same equipment as is used for the drying of solids would be equally well suited for these applications. The same applies to reactions such as the denitration of metal nitrates to recover oxides of nitrogen and the decomposition of metal sulfates, sulfides and other compounds.

The operations can also involve handling the materials as preformed or briquetted feed for processing in rotary kilns, continuous conveyor units, moving-bed and other equipment.

Catalytic Petroleum Reactions

As mentioned above some of the most significant and valuable advances in recent years in the development of more efficient solids-gas contacting equipment have originated in the petroleum industry relative to the catalytic cracking of petroleum. The two methods developed—moving-bed and fluidized-solids—have proved to be of tremendous value to other refinery operations such as adsorption, reforming and heat transfer.

Some progress has been made in the application of the fluidized-solids method to operations in the chemical and metallurgical industries. Considerable effort is being exerted at this time on similar uses of the moving-bed technique.

Roasting and Sintering Metals

Metallurgical roasting may be defined as an operation whereby an ore is heated under such conditions that the metal values of the ore will be changed to some other form more suited for subsequent treatment. This product might be in the form of an oxide, sulfate, chloride or other compound.

If a metallic sulfide ore is heated under atmospheric air the solid under-

goes a series of changes involving decomposition and other reactions of the type we have discussed. The changes:

- An initial drying phase below 100 C. to drive off mechanically-held moisture.

- With further increase in temperature above 100 C., chemically-bound water and volatile carbonaceous matter are expelled along with carbon dioxide from the decomposition or calcining of the carbonate.

- Metallic sulfides react with oxygen from the air to form oxides and sulfates of the metals as the temperature approaches a red heat.

- Sintering or fusion of the unreacted sulfide may occur.

We can see from this typical illustration that solids-gas contacting is very important in metallurgical operations. Many of the techniques—particularly the new ones such as moving-bed and fluidized-solids—should be well suited for such applications. Naturally

the relative advantages of these new methods must be compared to existing techniques on the basis of investment and operating costs as well as technical feasibility.

A related operation in the metallurgical field is the preparation of preformed feed or briquettes that may be charged to a batch or continuous furnace. These briquettes may actually consist of intimate mixtures of a metal oxide or halide and a reductant such as carbon or magnesium.

When the briquette is heated to the ignition point the reaction proceeds. Sweep gases may be used to provide a heat transfer medium and inert atmosphere. The variations of such procedures using alternate methods of solids-gas contacting are manifold.

It appears certain that considerable economies can be accomplished by proper selection and development of new techniques.

also applicable to the drying of many heat-sensitive materials. An additional advantage is the ease of control and variation of product properties.

Among the inherent disadvantages are the relatively low product bulk densities. The equipment, particularly the atomizers, is relatively inflexible and larger evaporative loads are required of spray dryers for a given throughput because of dilution effect.

The spray technique has been adopted for many new and interesting applications over the past few years. There is room for even wider application in chemical and metallurgical fields provided appropriate designs for atomization, dust recovery and gas recirculation are incorporated for each specific use.

Rotary Equipment

Rotary equipment may be grouped into kilns and dryers depending on the operation performed. The direct single-shell rotary dryer consists of an inclined rotating cylinder in which wet material showers through the gas due to lifting flights attached to the cylinder wall. In the indirect-direct rotary dryer the material receives heat from the hot gases by conduction through the dryer shell and by direct contact.

Where the word dryer appears in the above descriptions, it should be understood that this equipment may, with modifications, be used for conducting operations other than drying.

In the rotary kiln the material travels as a solid bed on the bottom of the rotating cylinder. Rotary kilns are used extensively for roasting, calcining and sintering. Drying is usually secondary to the other desired reactions.

To accomplish the drying or chemical reaction, hot gases flow either concurrent with or countercurrent to the flow of solids. Although counterflow provides more efficient heat transfer, concurrent flow allows the drying of heat-sensitive materials at higher temperatures. Hot gases are forced through the equipment by a blower and/or exhaust.

The hot exhaust gases from the rotary equipment may contain dust particles which can be processed in wet or dry collectors to avoid contamination of the atmosphere or improve product recovery. The practice of cool-

Commercial Equipment for Solids-Gas Contacting

We will review briefly the equipment available for bringing a gas and a solid into contact so that drying, chemical reaction or heat transfer may occur. The equipment used commercially may arbitrarily be divided into eight major categories: spray, rotary, tunnel, tray, conveying, fixed-bed, fluidized-bed and moving bed. These are taken up under separate headings and the more important types are shown in sketches on the following pages. The table illustrates the varied operations that can be performed with this equipment.

A brief description is given of the more important types of equipment, along with advantages, limitations and applications. We will also list some factors of importance in the selection of equipment for solids-gas contacting operations. Although they may be at variance with present practices—which are often dictated more by custom than by reason—recommendations are set forth for the types of equipment that might be considered for various operations.

Since there are many intangibles involved in any operation, it is not pos-

sible to present concise and comprehensive criteria for the optimum procedure for conducting a given operation. However, we have tried to list the more important factors which should be considered in the selection and design of any solids-gas contactor.

Spray Equipment

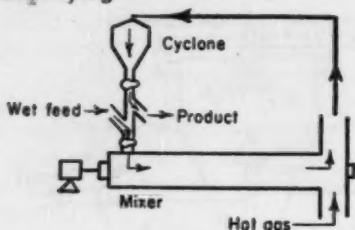
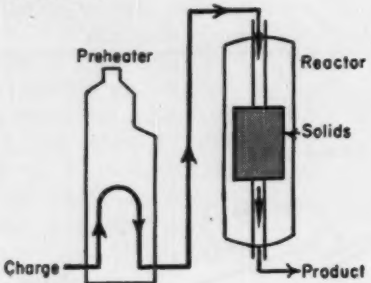
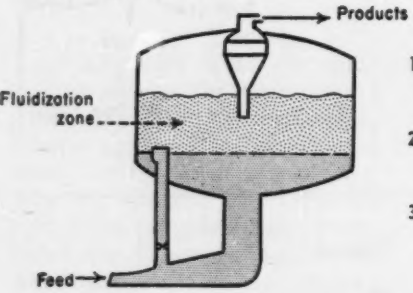
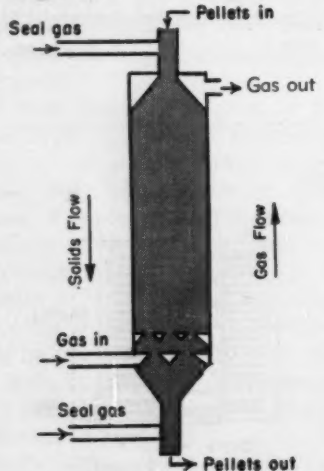
In spray equipment, the material to be contacted is fed into a hot gas stream as a highly dispersed liquid slurry or solution. A typical spray unit consists of: a contacting chamber, a source of hot gases, a means for atomizing the liquid feed, and a means for separating the finely divided product from the exhaust gases.

Spray equipment may operate with countercurrent or parallel gas flow. The hot gases may be used in a once-through operation, or recirculated through the unit in a closed system. Inert gas, superheated steam or other vapors can be used as contacting media where a special atmosphere is desired.

Spray drying is one of the few commercial-scale operations suitable for the drying of liquids and slurries. It is

Operation	Industries	Notes	Equipment
<ol style="list-style-type: none"> 1 Decomposing chemicals such as nitrates and hydrates. 2 Cooling chemicals such as NaHSO_4, NH_4NO_3, soap. 3 Drying pharmaceuticals, foods such as soluble coffee and milk, chemicals such as resins, salts, pigments. 4 Formation of pellets for further processing in moving-bed, rotary kilns and other equipment. 	Chemical, drug, food	Spray technique becoming increasingly versatile in application	<p>Spray</p>
<ol style="list-style-type: none"> 1 Calcining materials such as cement, lime-stone, dolomite, magnesite and pigments. 2 Sintering of iron ore. 3 Reduction of BaSO_4 and Na_2SO_4. 4 Decomposing materials such as FeSO_4 and phosphate rock. 5 Drying of ore, stone, sand, coal and chemicals. 6 Chemical conversion of solids such as oxidation, sulfatization, halogenation, reductions, etc. 	Building, paint, steel, chemical, coal, etc.	Already well established and will continue to be important for large tonnage operations	<p>Rotary</p>
<ol style="list-style-type: none"> 1 Drying of ceramics, leather, wallboard, veneer, tobacco, rayon cakes, food, etc. 	Pottery, clothing, etc.	Largely limited to drying, baking, and curing operations	<p>Tunnel</p>
<ol style="list-style-type: none"> 1 Cooling, solvent recovery, heating, sublimation, curing of various materials. 2 Widespread drying of particulate materials. 3 Chemical conversion of solids. Many of the same uses as for rotary equipment but for smaller capacities. 	Chemical, food, drug, sewage disposal, etc.	Already has wide applications	<p>Tray</p>

SOLIDS-GAS CONTACTING . . .

Equipment	Operation	Industries	Notes
Conveying 	<ol style="list-style-type: none"> 1 Chemical reactions between solids and gases. 2 Regenerating reforming catalyst. 3 Catalytic cracking of petroleum. 4 Widespread drying of chemicals, pigments, sewage sludge, etc. 	Petroleum, chemical, etc.	Wide application in sequence of operations involving handling of discrete particles
Fixed-Bed 	<ol style="list-style-type: none"> 1 Generation of producer gas and water gas. 2 Catalytic cracking and reforming of petroleum. 3 Chemical reactions such as dehydrogenation of butanes. 4 Chemical conversions of gases and vapors. 	Fuel, petroleum, chemical	Use usually dictated by inherent process limitations such as capacity and cycle times
Fluidized-Bed 	<ol style="list-style-type: none"> 1 Catalytic reactions such as cracking and reforming of petroleum. 2 Chemical reactions such as calcination, oxidation, reduction, roasting. 3 Heating or cooling of solids or gases. 	Petroleum, chemical, metallurgical	Possibilities already extensively explored
Moving-Bed 	<ol style="list-style-type: none"> 1 Chemical reactions such as reduction and halogenation of metal oxides. 2 Reduction of iron and copper ores. 3 Calcining limestone. 4 Catalytic reactions such as cracking and reforming of petroleum. 5 Recovery and purification of gases by adsorption. 6 Heating or cooling of solids or gases. 7 Heat transfer (pebble heater). 	Metallurgical, chemical, petroleum	Will have a tremendous expansion of applications in the chemical and metallurgical industries

ing hot exhaust gases in waste heat boilers to produce steam is being supplanted by various methods of preheating the incoming feed (see *Chem. Eng.*, Oct. 1954, p. 188).

Rotary equipment is normally used for relatively free-flowing granular materials. Pastes and sludges are handled by special means such as premixing the wet feed with a portion of recirculated dry product, use of special flights, vibrators, slurry evaporating chains, etc.

Outstanding advantage of rotary equipment is its adaptability to handle a large variety of mineral, chemical and ceramic products, good quality and uniformity of product, flexibility of throughput and operating conditions.

Fine dusty materials usually cannot be handled in rotary equipment. Nor can solids which must meet demanding specifications of size and shape. Advances in mechanical design, provisions for recirculation of solids and improvements in thermal efficiency have resulted in a number of new uses for rotary equipment. Its most important competition in the future should be the moving-bed and fluidized-solids methods.

Tunnel Equipment

Material to be treated in tunnel equipment is placed on trucks which are moved semi-continuously through an enclosed tunnel in contact with hot gases. Gas flow may be parallel or countercurrent to the material flow.

The two types of gas flow may be combined in one piece of equipment. In the center-exhaust tunnel dryer, the feed end of the tunnel operates with parallel gas flow and the discharge end with countercurrent flow. The exhaust gases leave at the point of changeover.

In this instance the operation is adiabatic for a single pass through the tunnel. The tunnel dryer may also be operated at a constant temperature with crossflow of the gas through each truck followed by preheating between trucks. In this way the temperature and humidity of the gas are controlled effectively. This allows temperature- or humidity-sensitive materials to be dried.

Tunnel dryers are particularly suited

to drying materials that tend to warp and check, such as leather, wallboard and veneer. They are also used for drying large solids and special shapes. Food dehydration is another important application.

Very little information is available on either the performance or investment cost of tunnel dryers. Operating costs should be roughly comparable to those of tray dryers. It is probable that the applications of this technique to processes other than thermal drying, baking and curing will be rather limited.

Tray Equipment

Tray equipment is exemplified by the horizontal conveying screen and the turbodryer. These represent two different principles of solids-gas contacting. In the conveying screen the hot gas is blown through a permeable bed of material which moves continuously through the equipment on a perforated tray.

Hot air is blown across the solid material in the turbodryer. Most common turbodryer is the vertical rotating tray (or transfer) type. The wet material falls continuously on the top tray which, together with the trays below it, rotates around a central turbine fan. After each revolution the material drops through a radial gap to the next tray.

In the spiral or endless carrier turbodryer the wet solids move through the dryer on screen-bottom trays in the form of an endless close-pitched spiral.

When gas is passed through the bed, the solids must be in a form suitable for contacting. Some materials need no special preparation. Others must be preformed to permit through circulation of the gas. Glues, gelatine and pottery are some materials that are entirely unsuited for drying by through circulation.

Through circulation offers several advantages over cross circulation. Higher drying rates are obtained because of the large surface area exposed. This provides a shorter exposure at elevated temperatures.

Among the chief advantages exhibited by turbodryers over through-circulation dryers is the ability to handle different classes of materials without pretreatment of feed and ver-

satility as to operations performed. It should be emphasized that both the perforated tray and particularly the turbodryer are used for nondrying operations such as contacting, cooling, sublimation and solvent recovery.

Both the horizontal-conveying screen dryer and the turbodryer are unable to handle wet feed of liquid consistency. Nor are they able to compete costwise with the rotary dryer—except when the latter must be built of expensive materials because of contamination or corrosion problems.

There is such broad experience with tray equipment in laboratory and commercial practice that we can safely assume that full consideration will usually be given to it for any application. The through-circulation and turbodryer methods should be given consideration for many applications where suitable preforming of the feed is possible or necessary for subsequent operations.

Conveying Equipment

Conveying equipment is characterized by the fact that the solid material is agitated or moved while being contacted with a gas. It includes: screw and vibratory conveyors, contacting towers, gas lifts and belts. The conveying operation is of course incidental to the prime functions of drying, chemical reaction, etc.

The screw conveyor is used as a solids-gas contactor through which solid is conveyed as it contacts gas flowing in the same or opposite direction. Totally-enclosed vibrating conveyors are also used with screens or solid decks over which the solid moves, with the gas flowing through or across the solids.

In the tower contactor the solid cascades down a baffled tower against a rising gas stream. The solid material is simultaneously contacted and conveyed by means of a gas stream in the gas lift.

Each of these equipment types has inherent advantages and limitations. Most conveyors are characterized by flexibility of operation and low space requirements. The screw conveyor should not be used where product degradation must be avoided, nor the vibratory equipment for materials having long contact times. Due to the

short contact time—which may not be advantageous under certain circumstances—temperature-sensitive materials may be contacted in the gas lift. Very abrasive, brittle or sticky substances cannot be handled in a gas lift.

All classes of conveying equipment mentioned require a relatively free-flowing granular feed. Exception is the screw conveyor. It may handle some pastes and sludges.

It is probable that conveyors will continue to be used on a broad scale in both the chemical and metallurgical industries. However, it is our opinion that major inroads by such new processes as fluidized-bed and moving-bed methods will involve the replacement of many of the above operations.

Fixed-Bed Equipment

The use of equipment containing a fixed bed of solids for operations involving the contacting of gases and solids is very common. The solids range in size from $\frac{1}{8}$ in. to 3 in. and may be catalytic—as in the Houdriformer—or noncatalytic. Gas flow through the bed may be either upward or downward.

Fixed-bed processes have certain advantages over those in which the solids move continuously during normal operations. There is no appreciable solids loss due to abrasion and equipment is not required to circulate solids, or to separate solids to recover them

from gas streams. Fixed-bed units possess considerable flexibility.

Among the inherent disadvantages of fixed-bed methods is the difficulty of adding or removing solids during operation. Cyclic operations introduce valving and purging problems that are complicated by very high temperatures and large gas volumes. Due to relatively poor heat transfer characteristics, excessive temperature gradients often exist within the bed.

In many cases the use of fixed beds is required by the very nature of the operation. In general the use of fixed beds is so well known that no special emphasis need be placed on considering it for new operations.

Fluidized-Bed Equipment

A fluidized bed can be defined as one in which a mass of finely divided solids—ranging from 10 to 400 mesh—is maintained in a turbulent dense state by being dispersed in an upward-moving gas stream. The turbulence resembles that of a boiling liquid.

Fluidized-bed equipment is used for both catalytic operations such as cracking and reforming of petroleum and noncatalytic operations including calcination and roasting of ores.

There are some important advantages: good degree of temperature control and uniformity of temperature throughout the fluid bed, high heat

transfer and reaction rates, solids removal and makeup are possible and solid phase composition is uniform.

Inherent disadvantages: not adaptable to countercurrent operation, entrainment of solids in gas stream may be prohibitive, the extent of secondary reactions is increased by longitudinal mixing in the bed.

The fluidized-solids technique should have a broad and valuable potential for many new applications in the chemical and metallurgical industries.

Moving-Bed Equipment

The moving-bed principle is widely employed in industry, as indicated by its use in blast furnaces, shaft kilns and petroleum processing. A moving bed can be defined as a body of solids in which the particles—consisting of pellets, beads or briquettes; $\frac{1}{8}$ -in. or larger—flow downward by gravity at substantially their normal settled bulk density through a vessel in contact with gases. Gas flow may be parallel or countercurrent to the solids, providing the rate of gas flow upward is not high enough to cause the bed to boil as in fluidization.

The solids may be catalytic or inert as in the Houdriformer catalytic cracking process and pebble heater.

One of the major advantages of the moving-bed technique is that it lends itself well to the true intimate countercurrent contacting of solids and gases. This provides more efficient heat transfer and a more uniform driving force in the case of mass transfer. The moving-bed contacting method also permits the use of the solid as a heat transfer medium.

The efficiency of solids-gas contacting is high due to uniform distribution of the gas throughout the bed of solids. Feed preparation is an important factor and is largely determined by the physical requirements of the solids. Dust recovery is minimized in this type of unit since a packed bed actually functions as a fairly efficient dust-recovery medium.

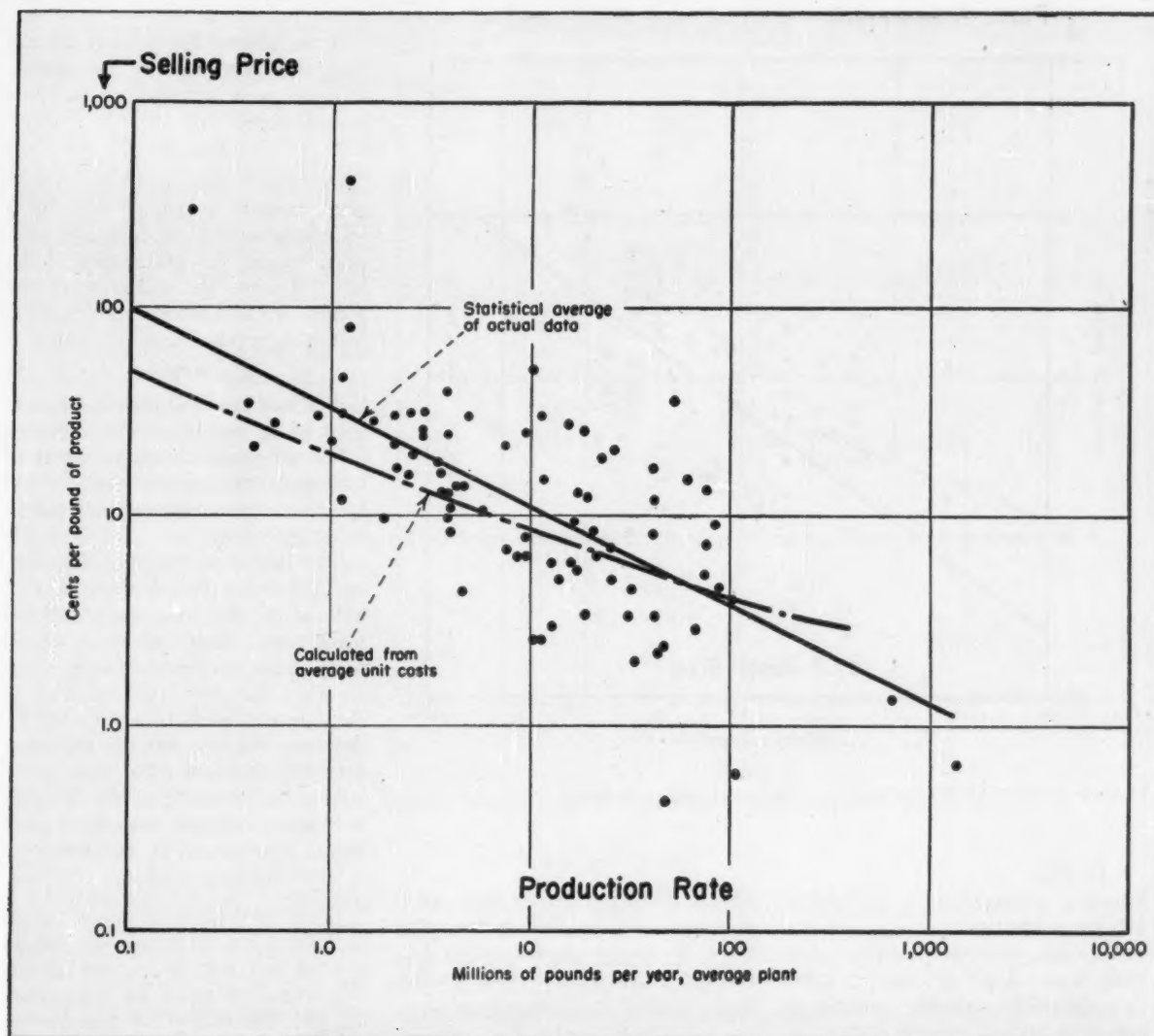
The moving-bed process has perhaps the best growth potential of any of the solids-gas contacting equipment discussed. For this reason, its application to the chemical and metallurgical industries will be discussed in some detail in a forthcoming *Chemical Engineering Report*.



RAYMOND E. VENER has had extensive experience in the application of new solids-gas contacting techniques to the atomic energy, chemical and metallurgical fields. Dr. Vener's assignments at Catalytic Construction have included research and development, process design, economic evaluation and sales.



LEWIS A. ROBINSON joined Catalytic as a process engineer in 1952 after four years with Socony Vacuum. His assignments have included development, design and economic evaluations in the petroleum and atomic energy fields, including considerable experience in the evaluation of alternate solids-gas contacting techniques.



How Plant Size Affects Unit Costs

Every engineer knows that bigger plants mean lower unit costs. Here's a quantitative analysis of this relationship for the average chemical.

S. C. SCHUMAN

As associate director of research for Hydrocarbon Research, Trenton, N. J., the author screens and evaluates all research projects. His article in March dealt with the relationship between total U.S. production rate and selling price of industrial chemicals. This one is concerned with the outputs from average plants.

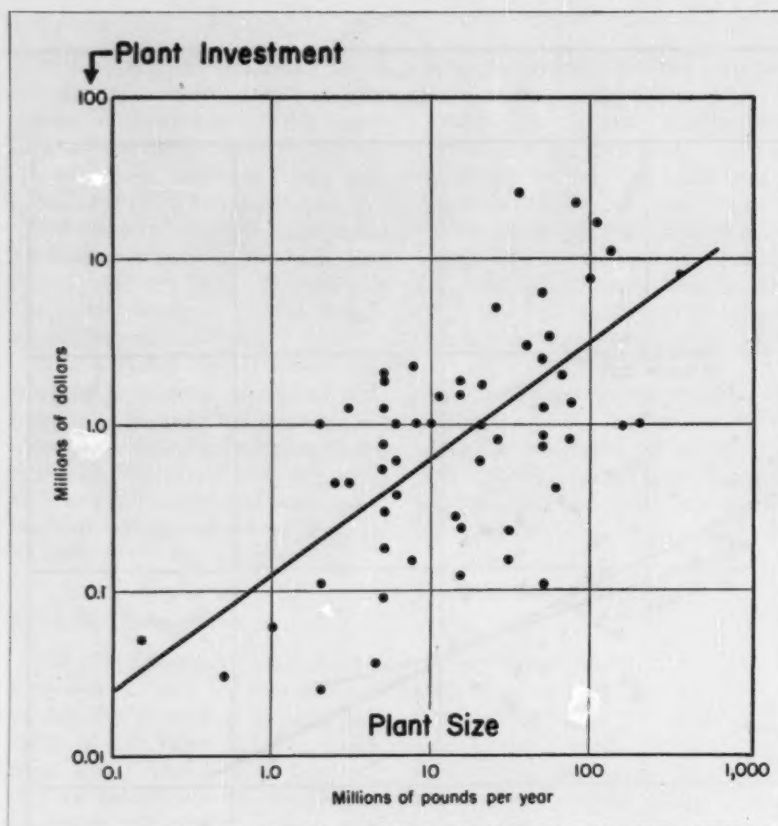
An earlier article⁷ presented a correlation of prices of 90 different industrial chemicals vs. annual quantities produced. For any given year we found that a logarithmic plot of price vs. total U.S. production led to a straight line of the form

$$P = bR^m \quad (1)$$

where P is selling price, R is produc-

tion rate, and b and m are constants.

In the present article we shall focus our attention on the individual unit charges—labor, materials, taxes and profit—which add up to the selling price. We shall derive generalized equations relating these elements of expense to production rate. We shall also see how the summation of these



PLANT INVESTMENT influences a number of unit cost items.

elements compares with the actual data for selling price.

Although these relationships obviously won't apply to specific cases, they should be valuable generally to engineers and economists concerned with the chemical industry.

As in the previous work, we shall limit our attention only to synthetic chemicals studied by Faith, Keyes and Clark,⁸ drawing from other published sources to get additional data on various cost components for many of these chemicals.

We shall use the year 1948 for our base. Where possible, we shall correct cost data for other years by use of suitable indexes. However, much of the published information is not specific as to time. We shall restrict our use of such data to sources published in 1950 and 1951 on the assumption that the figures, when published, were not over five years old and are thus applicable, on the average, to 1948.

One other point needs explanation, especially since it differs from the basis for the earlier over-all correlations. In this article we shall use

average plant production rates rather than total U.S. production rates. We get these average figures by dividing number of plants into total production.

Capital Costs

Since many elements of expense are related to, or dependent on, capital cost of the plant, let's look first at the relationship of plant cost vs. capacity.

The so-called "power rule" relating plant size and cost for a particular product or process has been suggested by Williams,¹⁰ Chilton,⁹ Nelson⁸ and others. This rule is expressed as

$$C_1/C_2 = (S_1/S_2)^n \quad (2)$$

where C_1 represents plant capital cost at plant capacity S_1 , C_2 is cost at capacity S_2 , and n is an exponent which is positive and less than 1.0.

We can rewrite Eq. (2) in a form similar to Eq. (1) to express the contribution of plant capital cost to the selling price of any chemical:

$$K = cS^n \quad (3)$$

Here K is expressed in terms of capital charges per unit of production. Exponent $y = n - 1$, thus is between zero and -1.

If we assume for purpose of this study that plant capacity and production rate were synonymous in 1948, we can write

$$K = cR^y \quad (4)$$

Using data from Faith for average plant capacity vs. capital cost for a wide assortment of products and processes, we get the plot shown at the left. Despite the scattering of the points, we can derive statistically a best straight line whose equation is

$$C = 0.126S^{0.70} \quad (5)$$

C is in millions of dollars; S is in millions of lb. per year. The exponent 0.70 corresponds closely to values of 0.66 and 0.68 reported by Chilton⁹ for plots involving individual chemicals or processes.

The center of gravity ("log average") for the plotted points is 10.5 million lb. per year and \$750,000 plant cost. Mean deviation of all points from the line is ± 0.53 in log C . Thus the capital cost indicated by the line at a given plant capacity varies from the true cost, in the mean case, by a factor of about three.

We can rewrite Eq. (5) in terms of capital investment per unit of product, in ¢ per annual lb., as follows:

$$K = 12.6R^{-0.30} \quad (6)$$

If we assume that certain cost items are adequately expressed as percentages of unit investment,⁸ we can derive numerical terms for them from Eq. (6). For example, if annual maintenance cost is 10% of plant investment, its contribution to selling price for the average chemical would be

$$W = 1.26R^{-0.30} \quad (7)$$

And if we take depreciation, local taxes and insurance respectively at 6%, 2% and 1% of plant cost annually, their total contribution to selling price would be

$$D = 1.13R^{-0.30} \quad (8)$$

Raw Material Costs

Faith gives unit raw material requirements for manufacture of the various industrial chemicals. We can readily calculate raw material costs per unit of product from these figures by applying the proper prices for the materials.

If we use prices from Faith for some of the materials, supplemented by price data from "Chemical Facts and Figures,"¹¹ we come out with the plot shown at the right. Equation for

the straight line is

$$M = 11.2R^{-0.37} \quad (9)$$

with M in ¢ per lb. of product.

Mean deviation corresponds to a factor of 3 to 4 in raw material cost. Log-average production rate for the chemicals considered is 8.1 million lb. and log-average raw material cost is 5.2¢ per lb., which is about half the average selling price of the chemicals considered.

Our prices for raw materials are too low in some cases, because they ignore freight charges, and too high in other cases, where they ignore long-term discounted contracts or where the producer makes his own raw materials. The predominant error is on the high side, since in 11 out of 64 chemical products the calculated cost of raw materials either equals or exceeds product price. However, we shall make no attempt to correct the raw material prices as obtained.

Labor and Other Costs

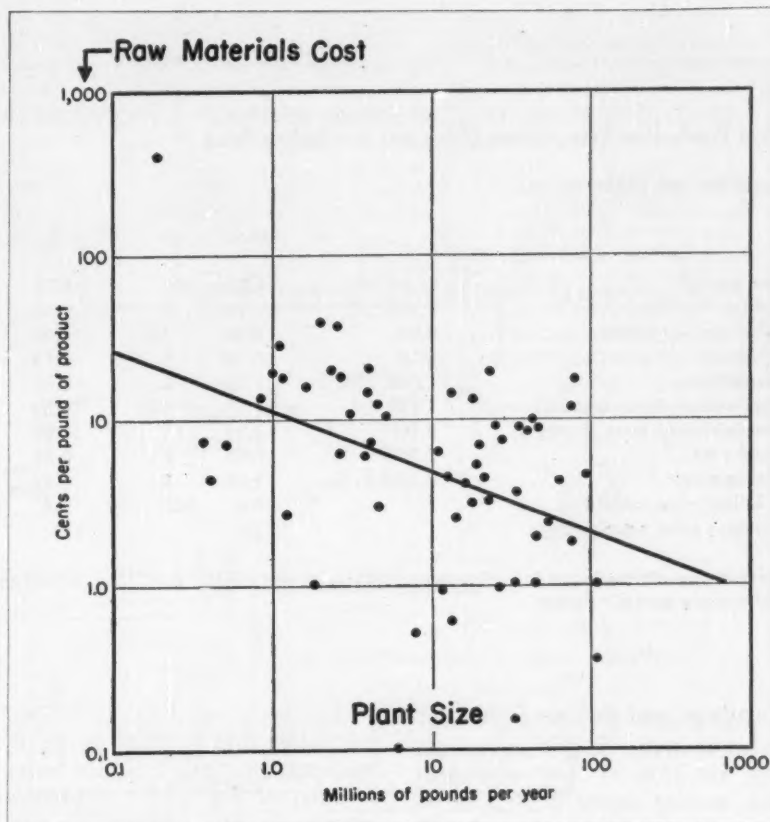
In an attempt to correlate operating labor data for chemical processes, Wessel⁸ plotted man-hours per ton per process step vs. plant capacity in tons per day on logarithmic scales. He got a straight line with a slope of -0.76 . On this basis we might relate labor to production rate with an equation like

$$L = aR^{-0.76} \quad (10)$$

This indicates that, per process step, operating labor per unit of production decreases appreciably as plant output goes up. The trouble is, we don't know whether chemicals produced in large-tonnage plants require more or fewer process steps than those produced in small-tonnage plants.

Wessel got the data for his correlation from Chilton⁴ and from Faith.⁵ Chilton had published data on man-hours per ton for operations in "typical commercial size" plants; Faith supplied information as to "typical plant sizes."

We have found in the present study no correlation between Chilton's man-hour data and the average plant sizes as previously defined. In the face of Wessel's success in getting a satisfactory correlation we must conclude that the number of process steps needed to make chemicals produced in large-tonnage plants is generally greater than the number used for small-tonnage chemicals.



RAW MATERIALS contribute substantially to product selling price.

Our inability to define a trend toward lower labor requirements for large-tonnage plants might also indicate that these plants are based on older processes, are not as well instrumented, or handle a greater proportion of solids than small-tonnage plants.

Lacking any definite correlation with production rate, we shall use Chilton's data to get an average of 2.5 man-hours per ton for the 24 chemicals which both he and Faith report. At a 1948 hourly rate of \$1.60, therefore, average operating labor cost for these chemicals is \$4 per ton, or 0.2¢ per lb. Expressed in the same algebraic form as our other elements of cost,

$$L = 0.2R^0 = 0.2 \quad (11)$$

Other costs related to labor are supervision and overhead. If supervision is 20% of labor and overhead is 60% of labor plus supervision, we get, for supervision,

$$F = 0.04 \quad (12)$$

and for overhead,

$$B = 0.14 \quad (13)$$

A set of charts published in *Chemical Engineering*¹ summarizes power, steam and water requirements for the manufacture of a large number of chemicals. Although we might assume that some economies in the over-all cost of utilities might be obtainable with increased consumption by larger plants, such factors are difficult to evaluate.

Let us arbitrarily assume, therefore, that utility costs are 10% of raw material costs, or

$$U = 1.12R^{-0.37} \quad (14)$$

For the total of general administration, selling and research expenses we shall assume a figure equal to 10% of selling price,⁹ or

$$A = 0.10P \quad (15)$$

To get total cost of sales, we add the individual cost elements, as follows:

$$\begin{aligned} T &= M + U + W + D + L + F \\ &\quad + B + A \\ &= 11.2R^{-0.37} + 1.12R^{-0.37} \\ &\quad + 1.26R^{-0.30} + 1.13R^{-0.30} \\ &\quad + 0.2 + 0.04 + 0.14 + 0.10P \\ &= 12.3R^{-0.37} + 2.39R^{-0.30} \\ &\quad + 0.38 + 0.10P \end{aligned} \quad (16)$$

How Production Rate Affects Unit Costs and Selling Price

Production rate, million lb./yr.		1		10		100		1,000	
		¢/lb.	%	¢/lb.	%	¢/lb.	%	¢/lb.	%
Raw materials.....	$11.2R^{-0.37}$	11.20	55	4.78	51	2.02	46	0.87	38
Utilities.....	$1.12R^{-0.37}$	1.12	5	0.48	5	0.20	5	0.09	4
Labor and supervision.....	0.24	0.24	1	0.24	2	0.24	5	0.24	11
Overhead.....	0.14	0.14	1	0.14	1	0.14	3	0.14	6
Maintenance.....	$1.26R^{-0.30}$	1.26	6	0.63	7	0.32	7	0.16	7
Depreciation, taxes, insurance.....	$1.13R^{-0.30}$	1.13	6	0.57	6	0.28	6	0.14	6
Administration, sales, research.....	0.10P	2.02	10	0.94	10	0.44	10	0.23	10
Income tax.....	$0.50(P - T)$	1.66	8	0.83	9	0.40	9	0.20	9
Net earnings*	$0.50(P - T)$	1.66	8	0.83	9	0.40	9	0.20	9
Selling price, calculated.....		20.4	100	9.4	100	4.4	100	2.3	100
Selling price, actual average.....		32.4		11.0		3.7		1.3	

*Net earnings are equivalent to 10% return on total investment = $0.10(12.6R^{-0.30} + 0.20P)$ where fixed investment per annual lb. = $12.6R^{-0.30}$ and working capital = 0.20P.

Earnings and Selling Price

Let us assume that net annual earnings are 10% of total investment, that working capital is 20% of annual sales, and that income tax is 50% of gross earnings.

Expressing net earnings in terms of investment,

$$E = 0.10(12.6R^{-0.30} + 0.20P) \\ = 1.26R^{-0.30} + 0.02P \quad (17)$$

Expressing selling price in terms of costs and earnings,

$$P = T + 2E \\ = 12.3R^{-0.37} + 2.39R^{-0.30} + 0.38 \\ + 0.10P + 2.52R^{-0.30} + 0.04P \\ = 12.3R^{-0.37} + 4.91R^{-0.30} \\ + 0.38 + 0.14P \quad (18)$$

$$P = 14.3R^{-0.37} + 5.7R^{-0.30} + 0.44 \quad (19)$$

Thus we have an expression for the selling price of any chemical as the sum of three terms, at least two of which vary with production rate taken to a power of about -0.33. (On an annual dollar basis, rather than a unit or pound basis, the power function would be in the familiar +0.67 range.) The third term is shown here as invariant because of our failure to obtain a correlation of labor costs with capacity.

Eq. (19) is shown graphically on page 173, along with actual price data for the chemicals included in this study, plotted against average plant output.* The best straight line fitting the actual data gives the equation

$$P = 32.4R^{-0.37} \quad (20)$$

Mean deviation of Eq. (19) from the plotted data is ± 0.39 in log P, compared with ± 0.35 for the mean deviation of Eq. (20). Differences between the two equations are relatively insignificant except at the extremities in plant size, both large and small.

Analyzing the Results

We can calculate the data in the table above by applying Eq. (19) to various assumed plant outputs. Note how the cost of raw materials accounts for roughly half of the sales price across the board, with no other single item of cost greater than 11% of price.

Even that 11% labor item seems to be too high. In some typical manufacturing cost breakdowns reported by Wessel⁸ the cost of labor and salaries ranged from 3.4 to 8.2% of selling price, with the percentage apparently uninfluenced by size of plant. Our straight 0.24¢ per lb. is probably on the low side for small plants and on the high side for large plants. With a more accurate labor cost correlation the slope of our curve for Eq. (19) might increase, bringing it into better agreement with Eq. (20). We just don't have enough information at present to pin labor costs down.

* Note that this correlation differs from that derived in the earlier article, where we plotted price against total U. S. output, to get $P = 55.4R^{-0.34}$. The lesser slope on the over-all basis is due, of course, to the fact that as total production increases, more individual plants come into operation.

In conclusion, we have demonstrated that all or most of the major elements of cost in the manufacture and distribution of industrial chemicals can be expressed in the form

$$X = yR^z \quad (21)$$

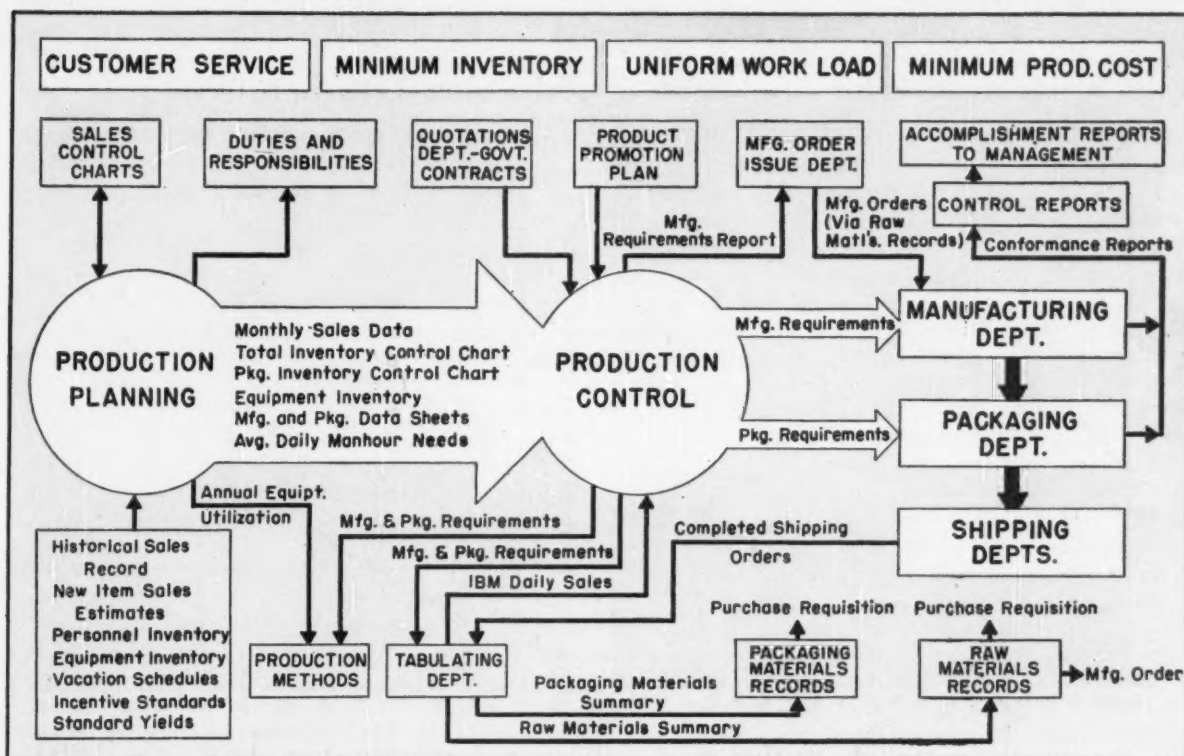
Factor y varies with the particular cost item considered and with the value of money at the time. Exponent z is roughly within the range of -0.30 to -0.50 and may be taken as -0.35 for most cases.

Eq. (21) is not applicable to any specific chemical with any accuracy. However, it is broadly descriptive of the behavior of a reasonably large sample of synthetic industrial chemicals.

The fact that production on a large scale leads to low unit costs and prices is, of course, well appreciated. What we have defined in this article is the degree to which this generality applies to industrial chemicals and the magnitude of the decrease in cost or price with increase in capacity.

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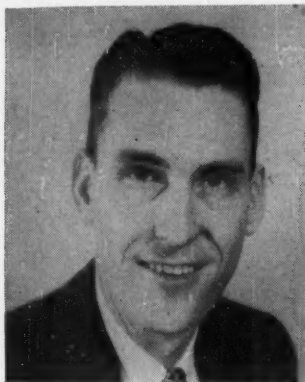


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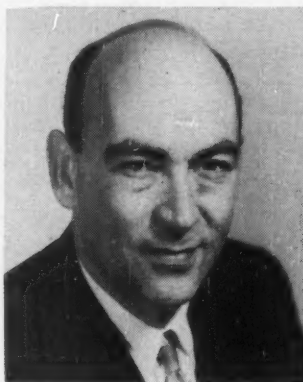
Production Planning and Control

Study this program for constructive ideas that apply to your operations. Manufacturing requirements are developed from a stepwise procedure starting with sales estimates.

E. F. RATLIFF and R. E. HEINE



EUGENE F. RATLIFF is assistant treasurer of Eli Lilly and Co. He has served as manager of the internal auditing department, staff assistant to the treasurer, and administrative assistant to the director of operations planning.



ROBERT E. HEINE is director of Eli Lilly and Co.'s production planning division, which includes the following departments: finished stock planning, production planning studies and control reports, and production planning services.

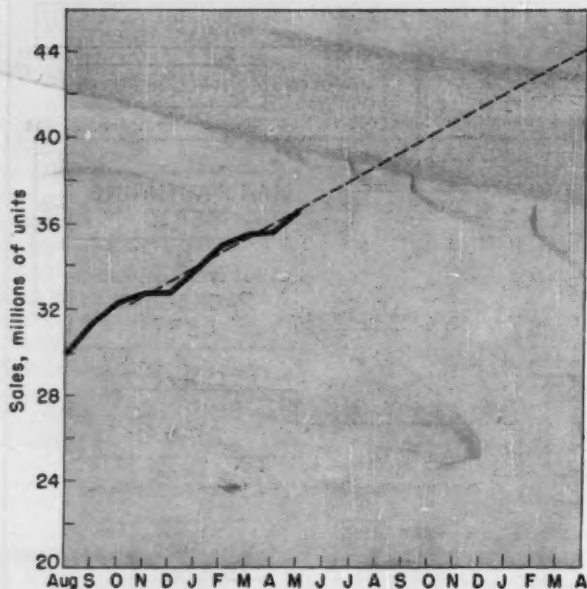
OBJECTIVES of production planning are the same for any company which manufactures for stock and subsequent sale.

They are customer service, minimum inventories, uniform work load, and minimum production cost.

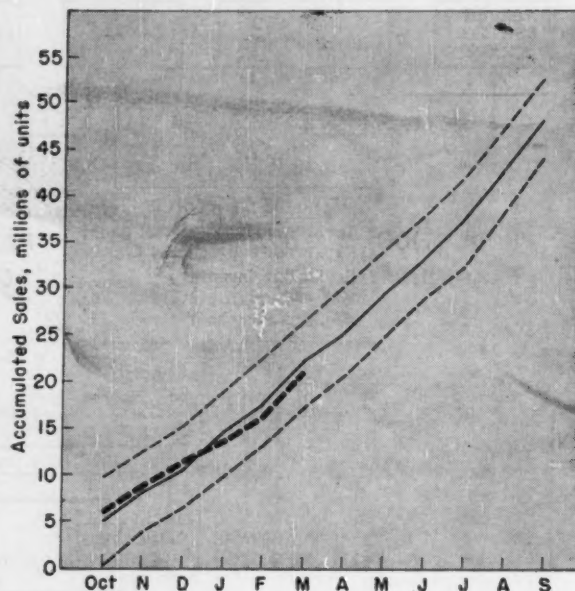
Our system assumes that we can forecast our sales accurately by item and by month within rather close limits. If this can be done, then the necessary inventory levels required to service customers can be predetermined. You can then schedule production so as to maintain a uniform work load with the resultant production economies.

It all involves determining what, when and how much will be needed. For the first step in the production planning process, [turn the page.]

Sales trends are basis for . . .



Sales control charts, basis for . . .



. . . Inventory control charts that work with manufacturing data sheets, (p. 180).

INVENTORY CONTROL CHART (All values times 1,000)						PRODUCTION CONTROL DEPT		
	Actual Inventory 1st of Month	Estimated Sales for Month	Actual Sales for Month			Est. Avg. Monthly Sales X 1,000	Theoretical Yield per Lot X 1,000	Standard Yield per Lot X 1,000
Oct.		5,040.0	5,484.3			4,000.0	2,100.0	2,062.5
Nov.		3,160.0	2,826.7			Est. No. of Lots per Month: 1.94		
Dec.		2,400.0	2,424.4			This section for packaging inventory control charts only: Cased _____ Shelf _____ Bottle No. _____		
Jan.		3,680.0	2,939.8					
Feb.		3,280.0	2,760.1					
Mar.		4,000.0	4,252.5					
Apr.		3,320.0				This section for total inventory control charts only: Bulk Cost per Lot \$38,976.00		
May		3,880.0						
Jun.		4,080.0						
Jul.		3,920.0						
Aug.		5,400.0						
Sep.		5,840.0						
PLANNED INVENTORY CONTROL CHART (All values times 1,000)						REMARKS		
	Actual Inventory 1st of Month	Minimum Inventory	Actual Inventory 1st of Month	Target Inventory	Actual Inventory 1st of Month	Maximum Inventory	Actual Inventory 1st of Month	
Oct.		10,765.4		10,765.4	11,181.9	16,490.8		
Nov.		6,749.8		9,725.4	9,822.6	13,315.2		
Dec.		5,126.4	8,937.1			13,291.8		
Jan.		7,800.5	10,588.5	12,165.4		16,345.9		
Feb.		7,006.1	11,689.1	12,485.4		16,211.5		
Mar.		8,544.6	13,041.8	13,205.4		17,749.4		
Apr.		7,091.5	12,641.1	13,205.4		16,976.9		
May		8,287.7		13,885.4		18,293.1		
Jun.		8,714.9		14,005.4		18,440.3		
Jul.		8,573.1		13,925.4		18,378.5		
Aug.		11,534.4		14,005.4		20,139.8		
Sep.		12,474.2		12,605.4		18,339.6		
						Date Effective <u>July 1, 1953</u>		
						IBM Code No. <u>65-00XX-1</u>		
						Item Name <u>Anti-Histamine Compd. #3</u>		
						Item No. <u>HGC XX</u>		
						Pkg. Size <u>Total Units</u>		
						Label Code <u> </u>		

Sales Trends

In figuring what will be needed, it's necessary to obtain a forecast of expected sales during the coming year.

Established Items—As a beginning point in estimating sales of an item which has been in our list long enough to have a pattern, we obtain up to four years' historical sales data.

Let's take an actual example of an established item which we will call HGC XX. This historical information is plotted on a chart which shows a moving twelve months' total sales.

From this moving total chart, trends are obtained. When the trend for the item for the next twelve months' period has been established, an estimate is made of the total sales that can be expected during that twelve months' period.

At this point in our planning, sales trends are reviewed by item with the market research division. It is through their acting in an advisory capacity that we arrive at any reasonable basis for departing from what appears to be the historical trend line of the item.

Having obtained the total projected sales for the next twelve months, we then use the historical sales data as a means of determining the seasonal trend for each item. This calculated seasonal trend, when applied to the twelve months being forecast, provides us with the estimated sales figures for each month. Thus we know when the item will be needed.

New Items—We have covered thus far only those items on which we have a great deal of historical data. This, of course, is not always the case. Lifeblood of the pharmaceutical industry is research, and new items are constantly being brought forth in man's fight against disease.

Forecasting of sales on new items is left entirely in the hands of market research. Until historical data becomes adequate as a basis for estimating, both total sales and seasonal variations go to production planning.

Sales Control Charts

Having once established our estimates, we then prepare a sales control chart which incorporates the seasonal fluctuation factors. From our beginning month we plot the expected cumulative sales for the next fiscal year.

This article is based on the Eli Lilly and Co. presentation given before the recent American Management Association manufacturing conference in Cleveland. For more details, refer to A.M.A. Manufacturing Series No. 216.

Eli Lilly manufacturers more than 1,200 separate items in some 5,500 different package sizes. Manufacturing process times range from less than a day to more than a year. Business is somewhat seasonal, with individual products ranging from a low of 67% to a high of 136% of average—Editor.

In such an estimate, some deviation is to be expected. If it becomes wide enough, some change in our plans should be made.

We incorporate two standard deviations into our seasonal fluctuations to provide both maximum and minimum sales control limits. These two standard deviations are statistically calculated variances that, based on past actual experience, will give odds that 95 out of 100 future variances will be within the limits of these deviations.

Accumulated total monthly sales are obtained and plotted on our sales control chart.

As long as the actual accumulated monthly sales remain within the control limits of two standard deviations, inventories are adequate. Within these limits of sales our inventories should be neither too high nor too low.

Whenever two consecutive months (representing accumulated actual monthly sales) fall outside of the two standard deviation limits, the trend line for the item is reviewed and a new sales control chart is prepared if such action is indicated.

Inventory Control Charts

For each item in our price list, a total inventory control chart is prepared by production planning and furnished to production control.

This chart is developed on the basis of estimated sales. It provides the desired minimum, target, and maxi-

mum inventories for each item as of the beginning of each month throughout the coming twelve month period.

Minimum inventory is calculated to be the estimated sales for the succeeding month, plus two standard deviations. Minimum inventories therefore are a function of estimated sales.

Target inventories for each month are a function of estimated sales and uniform monthly production. At some point during the year, target and minimum inventories are the same. In a seasonal item this would normally be the month preceding the beginning of the low sales period. Thus, target inventories would exceed minimum inventories for eleven months during the year. This is, of course, providing a build-up of inventories for the high sales period.

Maximum inventories are target inventories, plus two standard deviations. Reason for this is that estimated sales are based on two standard deviations, and if actual inventories reach or exceed maximum levels so established, sales estimates would be out of the control limits of two standard deviations.

There is one important exception to our maximum inventory level which arises from the desirability of always manufacturing an economical lot size. Thus, where one lot size exceeds two standard deviations, then the equivalent of one lot size is added to the calculated maximum inventory to obtain what might be called an operating maximum to produce that item in an economical quantity.

One of the most complicated problems with which we are faced in an inventory control method of this sort is the package size disposition. It is not so difficult in general to forecast the total unit sales of a certain item as it is to forecast the package sizes and label codes.

We use the same technique in building up the package size and label code inventory control charts as is used in developing the total inventory control charts. Because of our various labeling requirements in foreign countries, each different label requirement must also be considered as a separate package. We find in some items as many as twenty-five variations in packaging a single item.

Nevertheless, we provide (by using

PLANNING AND CONTROL . . .

MANUFACTURING DATA SHEET

Date: 1-25-54

1 Item HGC XX 6 Empty capsule code 92-0XX3
 2 IBM item code no. 65-00XX-1 7 Standard yield per lot 2,062,500
 3 Account no. of mfg. dept. K-282 8 Capsule size 3
 4 Lbs. 650 9 Total manhours per lot 213.5
 5 Theoretical yield per lot 2,100,000 10 Filling machine speed A-1

11 Manhours per operation	Variable In Minutes	Constant In Minutes	Total In Hours
a. Preparation	<u>1181.1</u>	<u>64.2</u>	<u>20.8</u>
b. Fill	<u>5577.9</u>	<u>337.4</u>	<u>98.6</u>
c. Sort	<u>5565.0</u>	<u>79.2</u>	<u>94.1</u>

12 Machine hours

	Variable In Minutes	Constant In Minutes	Total In Hours
a. Filling machine	<u>5577.9</u>	<u>337.4</u>	<u>98.6</u>
b. Dry mixer (1,200 lb.)	<u>72.0</u>	<u>120.0</u>	<u>3.2</u>

13 Standard Cost \$18.56 / m HGC's , \$38,976.00 / lot of HGC XX

percentage disposition of estimated sales of all package sizes and label codes), a sales forecast and an inventory control chart by package size and label code—setting forth the desired inventories at the beginning of each month for each package size and label requirement.

Manufacturing Data Sheets

Manufacturing data sheets show among other things the manhour and machine-hour requirements. This is per lot information.

Shown in the table are these requirements for the material we are using as the example in the article, HGC XX.

Using this data sheet, the number of lots to be manufactured during the period under consideration is converted into the number of manhours and machine-hours required on the manufacturing requirements report below.

Manufacturing Requirements

One of production control's principal responsibilities is to develop a master

Manufacturing requirements are based on manufacturing data and inventory charts.

MANUFACTURING REQUIREMENTS REPORT

Page No. 8

Capsule Filling Department—Acc't. No. K-282

Date Prepared 4-12-54

Period Firm

From May 1, 1954 To May 31, 1954

Date Due in Mfg. 4-15-54

Line Symbol and Price List Number	Amount Required X 1,000	No. of Lots	IBM Prod. Code Number	Manhour Requirements				Machine Requirements in Hours		
				Preparation	Fill	Sort	Total	Filling Machine	Dry Mixers	
									1,200 lb.	400 lb.
HGC MM	1,826.0	1	65-00MM-1	21.7	102.1	73.7	197.5	102.1	2.8	—
HGC NN	86.3	1	65-00NN-1	2.7	6.4	3.5	12.6	6.4	—	2.0
HGC OO	417.9	1	65-00OO-1	6.5	35.0	25.6	67.1	35.0	3.1	—
HGC PP	11,448.5	5	65-00PP-1	118.0	794.0	911.0	1,819.0	794.0	21.5	—
HGC QQ	4,542.0	5	65-00QQ-1	54.0	304.0	173.5	530.5	304.0	16.0	—
HGC RR	319.4	1	65-00RR-1	5.5	19.9	33.4	58.8	19.9	—	3.1
HGC SS	3,425.8	2	65-00SS-1	42.2	190.9	244.6	476.8	190.9	7.4	—
HGC TT	861.0	1	65-00TT-1	15.0	46.9	60.3	122.2	46.9	4.0	—
HGC UU	734.2	1	65-00UU-1	8.8	70.0	37.8	116.6	70.0	3.1	—
HGC VV	1,808.1	1	65-00VV-1	21.6	96.3	98.2	216.1	96.3	2.8	—
HGC WW	4,418.0	2	65-00WW-1	53.0	268.4	192.2	513.6	268.4	6.0	—
HGC XX	4,125.0	2	65-00XX-1	41.6	197.2	188.2	427.0	197.2	6.4	—
HGC YY	8,608.0	5	65-00YY-1	102.0	375.5	347.0	844.5	375.5	15.4	—
Hours required at 100% efficiency				1,099.5	5,741.6	5,375.2	12,216.3	5,741.6	173.9	92.7
Total constant hours				165.7	865.3	810.0	1,841.0	216.0	—	—
Total hours required at 100% eff.				1,265.2	6,606.9	6,185.2	14,057.3	5,957.6	173.9	92.7
Total hours available							16,000.0	7,446.0	156.0	156.0
Percent utilization at 100% efficiency							87.9	80.0	111.5	59.4

plan consisting of a firm requirement for a 30-day period and requirements for two succeeding 30-day periods, known as first tentative and second tentative.

Let us take a look at HGC XX again and follow it through the steps, assuming we are preparing the requirements for the May firm requirement period.

Firm requirements in the production department that manufactures the filled hard gelatin capsule are due in the hands of the production people by the 15th of April, 12 working days prior to the start of the firm period. The tentative periods are issued at the same time.

The inventory control chart (p. 178) has been completed to the point where it shows actual inventories. Our object is to determine what should be produced during the month of May so that we will approximate target inventory by June 1.

This is done by merely taking the target inventory for June 1st, adding to that the estimated sale for April

and May, and from that sum deduct the actual current stock and process inventory as of April 1st. This is the quantity to be manufactured during the month of May. This quantity is translated into the number of full lots to be processed. In this case, 2 lots will be required to hold us near target inventory.

Man-hours and machine-hours determined from the manufacturing data sheet are then recorded on the manufacturing requirements report.

It's necessary that totals be obtained for all items in the manufacturing center. All of these totals are expressed at 100% efficiency, and a percent utilization is developed at that 100% efficiency.

As was indicated earlier, one of the basic responsibilities of this control method is to develop manhour requirements that are uniform, insofar as is possible. In most instances this can be done by juggling manufacturing orders requiring varying manhours from one period to another and still hold inventories near target.

Packaging Requirements

Packaging requirements are developed in a fashion similar to that used in preparing the manufacturing requirements, with the use of packaging data sheets and packaging inventory control charts.

This report shows that the 2 lots of HGC XX should be put into 25's, 100's and 1,000's. It also shows the label code indicated (which refers to label copy required for certain countries), the IBM package code number, and total man-hours for each package size and label code.

This, also, is expressed for machine-hour requirements. The same computation, as is shown for HGC XX, is carried for each individual item that was on the original manufacturing requirements report.

Notice that the cottoning and capping machines are scheduled for 130% utilization. This would indicate that either overtime is necessary or hand operations must supplement this equipment to produce the required amounts.

Similarly, packaging requirements are based on packaging data and inventory charts.

PACKAGING REQUIREMENTS REPORT											
Page No. <u>27</u>		Dry Products Department-Account No. K-285						Date Prepared <u>4-11-54</u>			
Period <u>Firm</u>		From <u>May 11, 1954</u> To <u>June 8, 1954</u>						Date Due <u>4-20-54</u>			
Line Symbol and Price List Number	Package Size	Label Code	IBM Package Code No.	Quantity in Primary Units	Package Distribution		Total Manhours	Machine Requirements in Hours			
					Shelf Stock	Case Stock		Lines 1,2,3,5	Line 4	Cotton & Coppers	Filling Machine
HGC XX	25-144		28	1,000	1,000	—	10.5	0.6	—	—	1.2
(2 lots)	25-144		42	1,000	1,000	—	10.5	0.6	—	—	1.2
(2,062,500/lot)	25-144		40	2,000	848	1,152	21.0	1.2	—	—	2.4
	25-144		20	4,400	2,096	2,304	46.2	2.6	—	—	5.2
	100-12		00	1,800	840	960	66.9	—	2.0	—	—
	100-100		00	21,150	11,150	10,000	211.5	13.8	—	15.2	24.6
				Reserve 600,000							
HGC YY											
(5 lots)	500-12	AJ	74	400	160	240	13.1	—	0.4	—	—
(1,721,600/lot)	30-100	CUX	28	1,000	200	800	10.7	0.6	—	0.7	0.8
	500-1	AX	00	40	—	40	6.1	—	—	—	—
	500-12	AX	00	8,000	800	7,200	262.4	—	8.8	—	—
	100-100	AX	00	35,780	4,780	31,000	310.1	20.9	—	25.6	26.8
Hours required at 100% efficiency							10,358.7	521.8	75.2	568.1	286.1
Special order allowance							1,582.0	76.0	2.0	56.0	74.8
Total hours required at 100% efficiency							11,940.7	607.8	80.2	624.1	360.9
Total hours available							12,320.0	640.0	160.0	460.0	480.0
Percent utilization at 100% efficiency							96.9	95.0	50.1	130.0	75.2

Germany Shifts to New Technology

Aided by a growing interchange of ideas and processes with the United States, the German chemical industry is adopting modern techniques to lessen its long-time dependence on coal byproducts.

KARL FALK

THE STERN realities of international competition are forcing West Germany to shift to new chemical raw materials. Similarly, limited capital and diminished domestic markets necessitate revising production methods to make intensified research pay off.

Over-all recovery since the war has been nothing short of amazing. Starting with literally nothing, Germany has again become one of the world's chemical leaders, though on a more modest scale than before.

But along with chemicals, which often are high priced when made from high-cost raw materials in the Bundesrepublik, Germans are exporting know-how both to underdeveloped areas and to highly industrialized lands with cheaper or more abundant raw materials. With the U. S. in particular a bilateral flow of ideas and processes is increasingly in evidence. And just about every segment of the German chemical industry is affected.

Strength in Intermediates

Analysis of Germany's import-export trade definitely shows the country's forte to be in furnishing intermediate and semi-finished materials, at least at present.

In the first half of 1954 the Bundesrepublik was a net importer (\$75 million) of crude chemical raw materials (chief imports: petroleum, tar; exports: potash, other salts); a net exporter (\$30 million) of semimanufactured materials (chief imports: cellulose, fats and oils; exports: fertilizers); a net exporter (\$130 million) of intermediates (chief imports: plastic materials; exports: coal tar dyes, intermediates and plastics); and a net exporter (\$145 million) of finished consumer end products (chief imports: foreign pharmaceuticals; exports: German pharmaceuticals).

During the past few years German

chemical industry has benefited much from a price drop in imported raw materials relative to the prices of exported German intermediates. Now chemicals are the country's second best export—over \$700 million in 1954—ahead of coal, behind machinery. Chemical exports far exceed imports and thus are a fine source of foreign exchange to pay for large imports of food and raw materials.

Petrochemicals Moving

To get West Germany started in "petrol-chemie," as the Germans call this branch of chemistry, will require initial investment of at least \$50 million, says Dr. Menne of the German Chemical Association. Though a small sum by U. S. standards, it's hard to raise in Germany because of a general shortage of venture capital.

Another deterrent is the scarcity of petroleum and natural gas. Less than a third of Germany's domestic petroleum needs are met by domestic production. The natural gas situation is even worse—only 0.5% of the total gas used is natural. However, this problem may be easing. Oil and gas outputs in West Germany are expected to double by 1960.

For the above reasons present plant facilities will continue to be used to make chemicals from coal. In new plants, however, and in those that can't get enough coal byproducts, petroleum and natural gas are becoming increasingly important. Now about 10% of the country's chemical output is petroleum-derived.

First German firm to use natural gas was Chemische Werke Huels, which pipes it from Emsland near the German-Dutch frontier. Then last year Farbwerke Hoechst, one of three leading I. G. Farben successors, started using gas—over 97% methane—to make solvents. This year Roehm & Haas will begin using natural gas to

make hydrocyanic acid, raw material for its Plexiglass and Plexigum.

Badische Anilin- & Soda Fabrik, another I. G. successor, is also busy securing natural gas for its various syntheses. BASF and Shell will soon be producing petrochemicals at Rheinische Olefin Werke near Cologne. Shell will make polyethylene and ethyl benzene from unsaturated cracking gases obtained from the adjacent plant of Union Rheinische-Braunkohlen-Kraftstoff, which just recently modified its hydrogenation plant to use petroleum feeds. Too, Phenol Chemie at Gladbeck will make cumene peroxide, phenol and acetone from benzene and propylene.

And a new plant to make ethylene and propylene from crude oil and residues is planned by Erdolchemie A. G., a new firm in Hamburg. Its output is to be further processed into solvents and plastics.

Changes in Benzene

For more economic operations, BV-Aral A. G. is building a centralized benzene refining and distillation plant at Gelsenkirchen. It'll be the hub of a supply-distribution network in the heart of the Ruhr.

Scholven-Chemie, which has been pressure-refining 80% of the crude benzene made in the Ruhr, is building what's claimed to be the world's first benzene pipeline—to the Gelsenkirchen distillation plant seven miles away. Chemische Werke Huels, which combines coal and petrochemistry, is a large user of pure benzene at Marl. It, too, is joining the Gelsenkirchen system, as are Gelsenberg-Benzine A. G., a large gasoline producer, Ruhrchemie A. G. and Oberhausen-Holtien.

The first unit at Gelsenkirchen, already running, redistills pressure-refined benzene to give pure benzene. Heart of the unit is a 157-ft. tower



KARL FALK is now Fulbright Lecturer at the Technische Hochschule in Stuttgart. Professor of Economics at Fresno State College, Calif., (on leave), he's currently studying relationships of raw materials to the chemical industries of Western Europe and lecturing on American economic problems, comparing American and German chemical industries.

and an adjoining 75-ft. column with tubular furnace, heat exchangers and coolers. Unusually sharp fractionation is claimed.

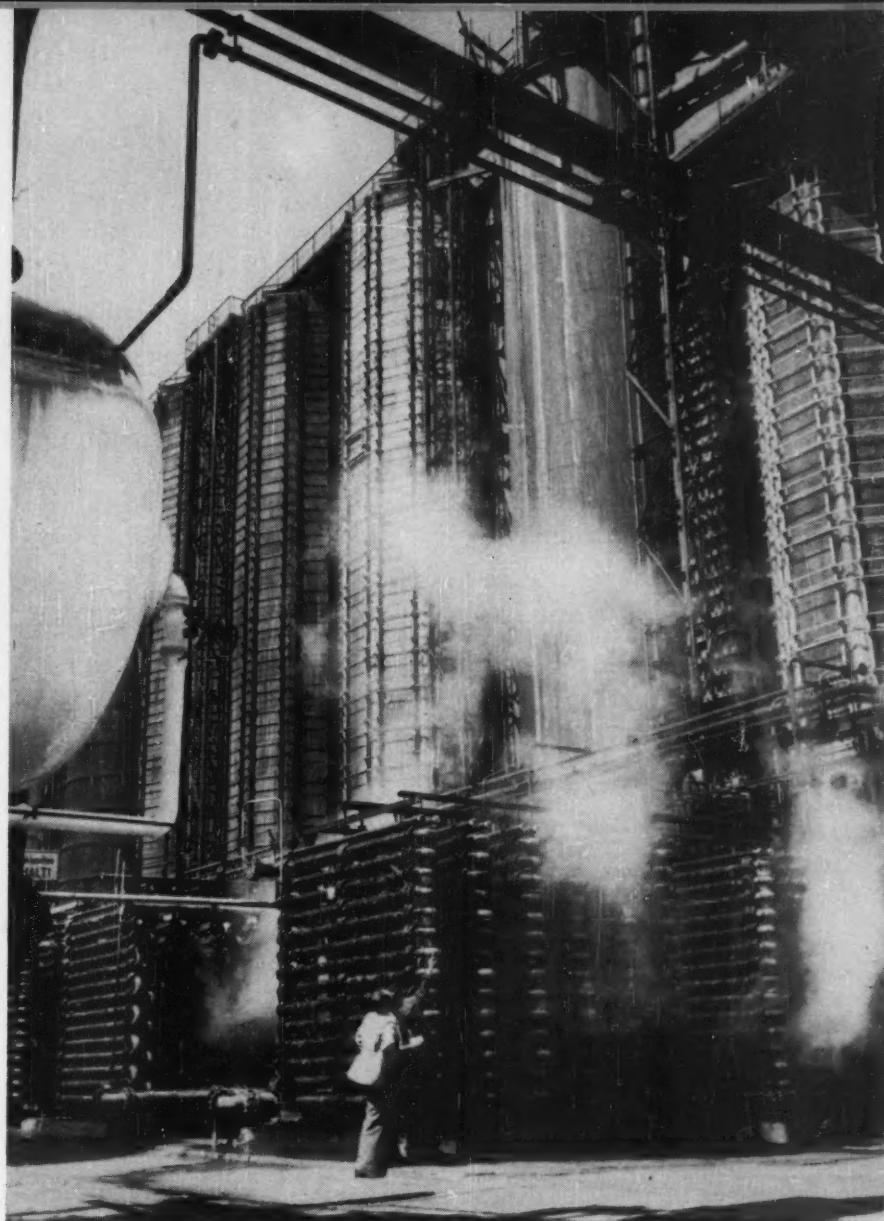
The second unit, now nearing completion, includes equipment to produce toluene, xylenes and aromatic solvents with boiling points of 300-480 F. When completed the total unit should process 400-500 tons a day of pressure-refined benzene.

Most of Germany's annual half million tons of benzene comes from coking plants and averages 80% benzene, 15% toluene, 3% xylene and 2% benzene solvents. About half the total is used as antiknock compound, the rest as chemical raw material. In the future its use as a source of aromatics will surely grow in importance.

Many Uses for Coal

In prewar Germany, more so than in the U. S., motor fuel production was closely allied with the chemical industry. Coal and lignite were important raw materials and the equipment and process used were developed by the chemical industry. In postwar America, petrochemistry has become the link between the two industries.

Compared with American techniques using petroleum and natural gas, German processes like Bergius and Fischer-Tropsch for making motor fuel from coal are expensive and cumbersome, at least with the prevailing oil-coal price ratio.



NITRIC ACID absorption towers: key part of Farbwerke Hoechst fertilizer plant.

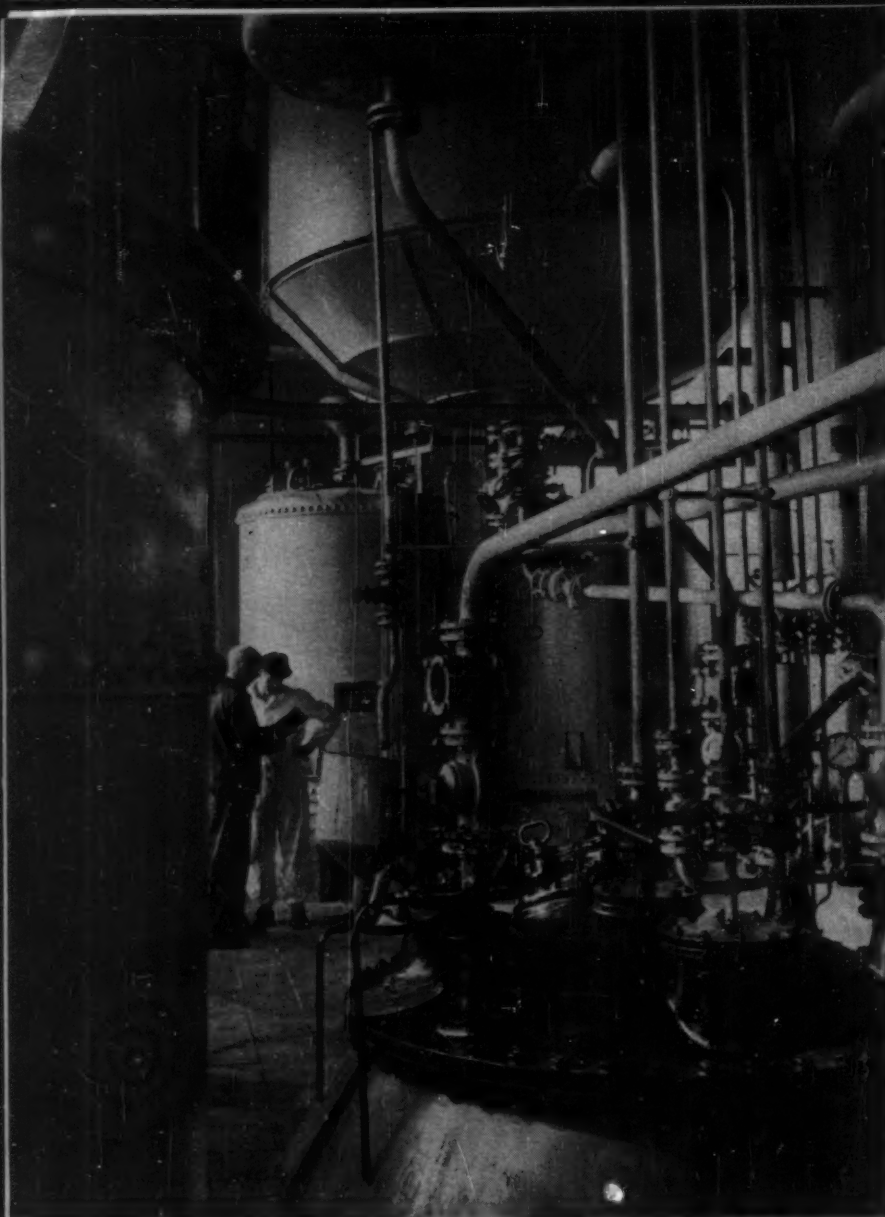
A quarter of Germany's wartime motor fuel was from domestic crude oil, but nearly half was from high-pressure hydrogenation of coal, which yielded three-quarters of the aviation gasoline used by the Luftwaffe. Only one-twelfth came via Fischer-Tropsch synthesis, which gave a low-quality gasoline, but good aliphatic raw materials. American cracking and German hydrogenation processes have been combined in most new refineries (\$170 million worth) built in West Germany since the war.

Catalytic pressure hydrogenation was well-developed in Germany by the late 1920's. American and other foreign firms were licensing it in 1929. With lower coal prices this technique could be used to make motor fuels.

Now, however, with low oil prices, it's better to start with distillation or cracking residues which need less processing and less hydrogen.

The lowest German cost for making motor fuel from central German lignite was achieved in 1944—reportedly 13-15¢ per gal. (Price conversions from Reichmarks to dollars for the war period are not very meaningful.) Then, 12 hydrogenation plants were running in the Reich with a capacity of 4 million tons of motor fuels a year.

The three plants located in East Germany are still producing gasoline, diesel oil, lube oils and paraffin, mostly from lignite and lignite tar. But because West German coal is so high-priced, the four plants in



DRUG MAKING'S on a big scale in Germany. Here, a Hoechst unit for pain killers.

that zone (Gelsenberg-Benzin, Rheinische-Braunkohlen-Kraftstoff, Scholven Chemie and Ruhröl) have switched to hydrogenating German and Middle East crude oil or their distillation residues by combining hydrogenation and cracking methods.

Poorer geological conditions and less mechanization are largely responsible for the Ruhr's low coal output (barely 1½ tons per man per shift, as against 6-7 in the U. S.). Gasoline, including taxes, costs Germans about twice as much as Americans.

Only one German plant, Chemische Werke Bergkamen in Westphalia, has gone back to Fischer-Tropsch. Its capacity is 36-48,000 tons of primary products yearly—about half its wartime peak. In the U. S.,

which has contributed fluidized catalyst to the synthesis, the process is viewed mostly as a way to process natural gas into liquid motor fuel to stretch petroleum supplies. Conversion into synthesis gas is simpler and costs about half as much as coal gasification (1.35¢ vs. about 2.7¢ per lb. of liquid product).

The future of Fischer-Tropsch in Germany lies in making, even from coal, valuable aliphatics, especially olefins and oxygenated compounds. Pure, uniform product results that can be utilized further in halogenation, polymerization, alkylation, oxidation, sulfonation, condensation, etc. Even during the war Fischer-Tropsch was more valuable in furnishing aliphatics, especially residual paraffin (gatsch),

than in supplying motor fuel. The detergent industry used C_{18} - C_{20} fractions for processing to fatty acids and alcohols through catalytic oxidation.

Until the Bergkamen plant started operating again in 1953—postwar restrictions and dismantling shut down Fischer-Tropsch plants—there was, and is now, a big shortage of higher members of the aliphatic series. Using an improved, but still costly, cobalt-thorium catalyst, Bergkamen has made some process and product changes. One material not formerly made is a new *n*-propyl alcohol good enough for cosmetics.

The present Bergkamen process is said to be about 50% more efficient than the old one. It starts with a different combination of raw materials (coke oven gas and water gas) so that coke oven gas is no longer cracked. It's also said to be easier on equipment and to use up less catalyst. Current plant output is 41% gasoline, 26% middle distillates, 11% paraffins, 8% gatsch, 3% alcohol, 2% "gasol" (C_8 and C_9 hydrocarbons) and 1% benzene.

Further economies as output rises should cut energy costs from their present 0.45¢ per lb. of final product. Also, since last fall, Bergkamen has been experimentally cracking gatsch. If production and new work on utilization of the resulting products are successful, the future of Fischer-Tropsch seems assured in Germany, even charging coal.

Acetylene Processes Needed

Acetylene chemistry is another prospect for future use of petroleum, natural gas and coal as raw materials. German coal is now 3-4 times as expensive as American, and about four times as costly as in Germany before the war. Also, coal-steam power costs are correspondingly higher—best cheap lignite is in the Soviet Zone. So the future of famed Reppe chemistry will depend largely on bringing down costs and developing new processes.

Incidentally, a benzene synthesis from acetylene is becoming industrially feasible. And acetylene, of course, has long been used to make acetic acid, acetone, vinyl chloride, chlorinated solvents and several other products in Germany.

During the war Dr. Reppe, head of BASF Ludwigshafen labs, and his associates started operating many new processes based on acetylene reacted under pressure, a procedure that had been considered quite dangerous. At the height of the war, when all German Buna rubber plants were running and urgently needed butadiene from acetylene, acetylene was being produced at 15.5 billion cu. ft. a year. Of this, 86% came from carbide, 14% from arc and oxygen processes.

These latter methods, using methane from natural gas and residual gases from hydrogenation plants, have been used since the war at Huels and Ludwigshafen, though acetylene from carbide is still most important.

Future economic feasibility of these processes will depend mostly on what happens to prices of raw materials, power and byproducts. For instance, cost of one lb. of 100% acetylene from carbide has varied between 8.7¢ and 22¢ in Germany since 1945. Electric power needed per lb. of acetylene using the arc process is 3.9 kwhr. with hydrogenation gases, 5.2 kwhr. with methane. However acetylene concentration is low—13-17%.

The process for making acetylene by incomplete combustion of methane with oxygen in a flame was developed at Ludwigshafen-Opau from 1936 to 1942. It's been used there commercially since then. Its requirements per lb. of 100% acetylene are 2.0 lb. methane, 2.2 lb. oxygen, 0.023 lb. solvent, 1.8 lb. steam, 0.7-0.9 kw. electric energy (for compressor motors).

In Opau acetylene was processed into acetone without concentration. Cost of concentrating this, oxygen-thermal acetylene is so high that it sometimes outweighs the high cost of electricity in carbide and arc processes. However, if residual synthesis gas can be processed further in the same plant—for instance, to ammonia or methanol—the oxygen process could be economical. Similarly, the arc process is feasible if cheap waste gas from hydrogenation plants or natural gas is available.

In heat efficiency, the three processes range from 56% for carbide, to 66% for the arc, to 75% for oxygen. Interest abroad in the oxygen process is indicated by the fact that

BASF is building several such plants in foreign countries, including one in the U. S.

German opinion on the future of acetylene chemistry is divided, largely because of costs. Everyone is aware that processes feasible in wartime Germany are not necessarily economically sound today.

Nevertheless, many feel that the acetylene work of Reppe and his associates is Nobel-prizeworthy. They point to the neatness of the process used during the war to make butynediol (top output, 21,500 tons a year), then butadiene for synthetic rubber, plus intermediates for synthetic fibers, and view this as a major contribution to the field of acetylene chemistry.

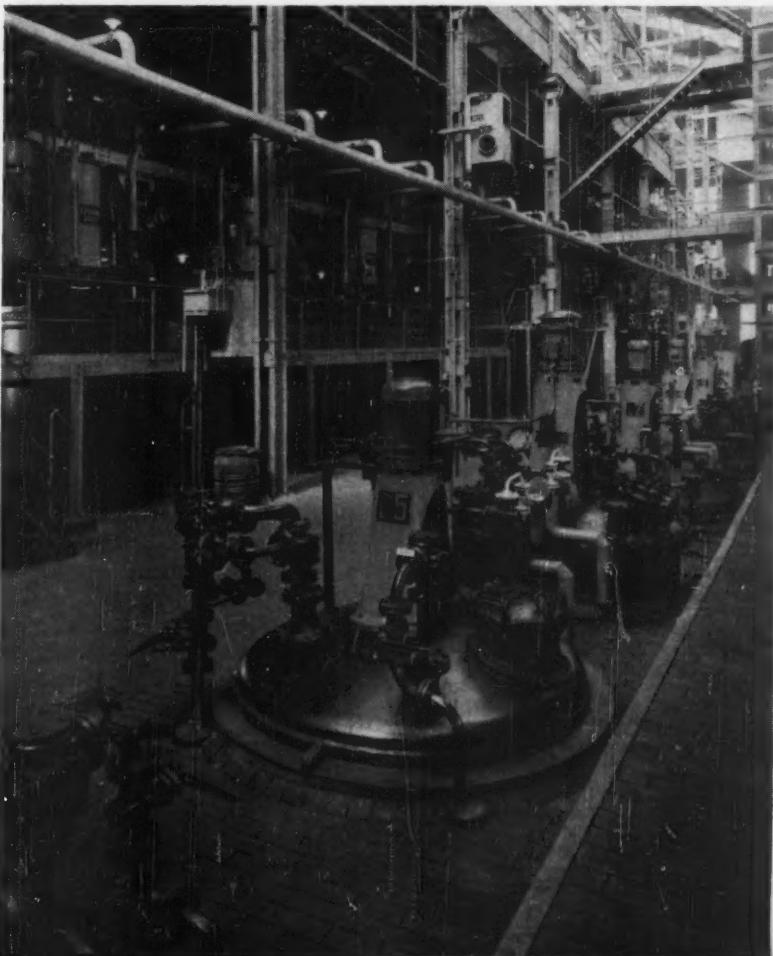
Butynediol was made from formaldehyde and acetylene with a copper acetylde catalyst to give butadiene by a process alternate to those from acetylene (acetaldehyde, alcohol, 1,3-butanediol) or from alcohol (the Russian Ledebev process) or from pe-

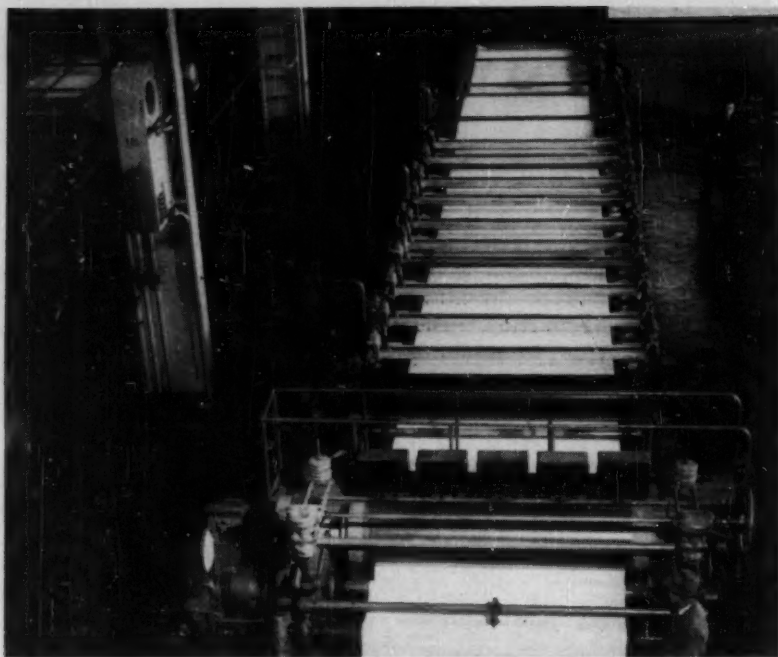
troleum hydrocarbons (U. S.) Butynediol was catalytically hydrogenated at 300 atm., and the resulting 1,4-butanediol was dehydrated in two stages to give, first, tetrahydrofuran and, finally, butadiene.

The intermediates (1,4-butenediol, 1,3-butanediol and tetrahydrofuran) gave both components needed for polyamide nylon. Tetrahydrofuran could be converted to adipic acid, either via 1,4-dichlorobutane and the corresponding dinitrile, or by direct reaction with carbon monoxide and water with nickel carbonyl catalyst. The second component, hexamethylene diamine, could be made by treating butenediol with hydrogen cyanide (cuprous chloride catalyst) to produce dicyanobutene, and then hydrogenating it.

Since the war a further German development with acetylene has been carbonylation—uniting acetylene with carbon monoxide in the presence of nickel compounds to give a 96% yield of acrylic esters.

AZO DYE plants, like Bayer's at Leverkusen, are basic to German chemical industry.





BUNA RUBBER is now made only at the Huels' plant in Marl, which will soon expand.

Fibers, Plastics, Ag Chemicals

In synthetic fibers and plastics the fruitful interchange of ideas and processes between nations is very apparent. Before the war there was much U. S. work on condensation fibers; Germany's accent was on polymerization fibers. The U. S. pioneered in nylon using the Carothers patent, while Germans developed "Perlon," a similar material based on Carothers-I. G. patents. With slightly different qualities, both products are now making headway in each other's country.

Germans experimented early in the war on an Orlon-like material while Americans perfected their own independently. Recently the improved product entered Germany. But Germany is now making its own acrylic fibers (Bayer-Dormagen), going back to earlier processes that were side-tracked during the war. Dacron, primarily a British development that was improved in the U. S., is following a similar path, though licensed to German producers by ICI.

Before the war Germany had much bigger incentive than the U. S. to replace scarce metals with plastics. Since then, however, America has surged far ahead in plastics research, production and uses. But though

unsaturated polyesters are being licensed from the U. S. in Germany, German processes for polyisocyanates and low-pressure polyethylene are going to the United States.

Brief mention should be made, too, of insecticides and herbicides. DDT, patented in Switzerland, was developed and made on a big scale in the U. S. before the war. Phosphoric agricultural chemicals, developed originally in Germany, then improved in America, are now finding their way back to Europe.

Costs Plague Synthetic Rubber

Military needs and consequent big spending for research and development gave Germany a considerable lead over the U. S. in synthetic rubber as World War II began. Most of the work was done by the Bayer section of I. G. American GR-S developed during the war is, in fact, very similar to German Buna-S.

Postwar Buna production in Germany at Schkopau (East Zone) and at Huels was set back by dismantling. Bayer still makes a little special Perbunan (with intermediates it gets from Huels), but lost much of its synthetic rubber labs through dismantling. Since 1951 Huels has resumed pro-

duction of Buna-S3 and is planning to boost capacity to 30,000 tons a year. When this expansion is finished next year, Huels should be able to supply nearly half of West Germany's rubber requirements.

Huels' problem has been to bring costs down to compete with imports from the U. S. The American price is about 23¢ a lb. It can be delivered in Hamburg for about 27¢. But the Germans can't make it profitably to sell for less than 32-36¢ per lb. High raw material costs and relatively small output are mostly to blame.

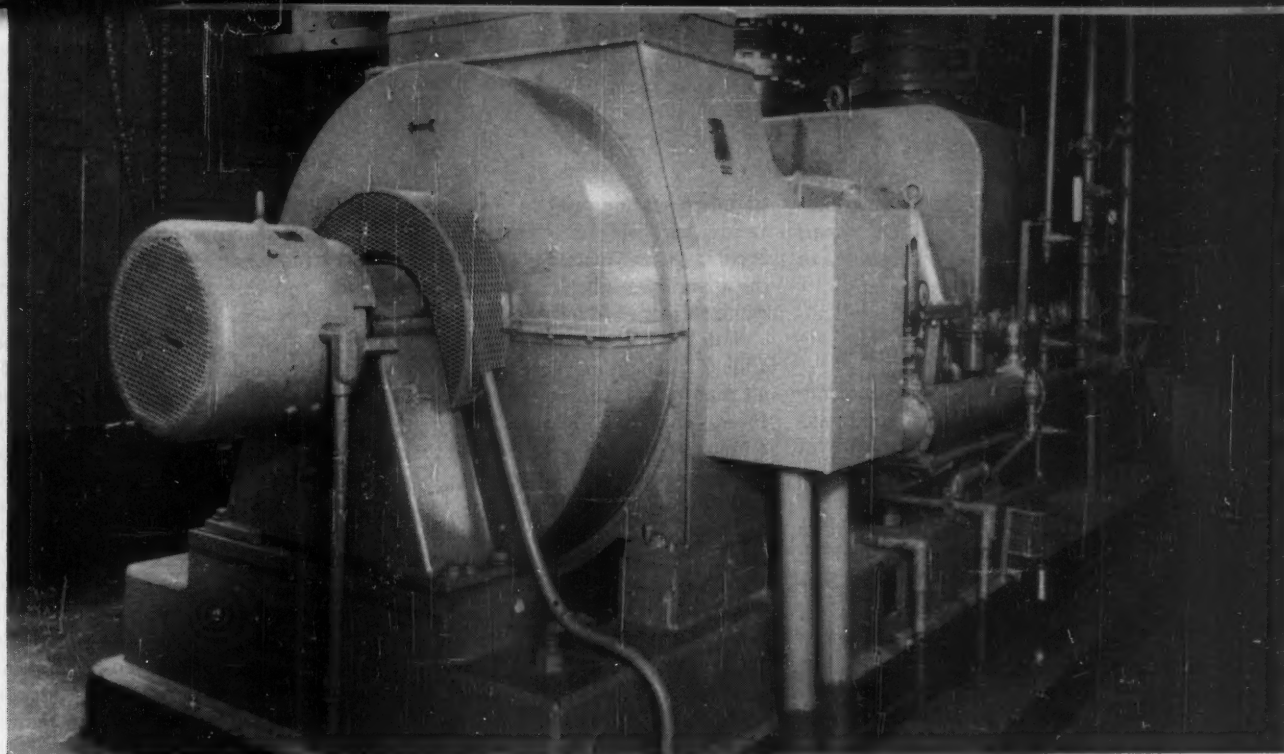
Huels has been considering either importing 50,000 tons of butane a year from the U. S. Gulf Coast or converting 190,000 tons of crude oil to butadiene via ethylene and ethyl alcohol. The latter would require bigger plant investment but would allow greater raw material flexibility.

American processes will be used to convert butane to butadiene, and also for further conversion into cold rubber. Recently, Continental Gummiwerke A. G. and Veith Gummiwerke concluded licensing and advisory arrangements with Goodyear and Goodrich, respectively, while Phoenix Gummiwerke has been working for some time with Firestone. All are interested in American cold rubber processes and tubeless tires, which are relatively new in Germany.

Need International Cooperation

The difficulties faced by Huels (which for awhile even planned to use surplus French alcohol in exchange for finished rubber—a plan that fell through) in finding cheap, available raw materials are typical of those faced by the entire German chemical industry. The availability of American innovations on basically German processes—a return flow of ideas from the United States to Germany—should help.

Of course the fact remains that—except for the first postwar years—Germany and the United States have long been keen competitors for expanding world markets. But there's still room for all. And experience has shown that there's also plenty of room for cooperation and international interchange of ideas and know-how between industries and personnel.



VENTILATING AIR for this 1,500-hp. synchronous motor enters through screens, hot air discharges through duct at the top.

In Process Plants . . .

Large Motors Need Special Protection

Not only mechanical and electrical hazards, but moisture and corrosion, explosive, abrasive and conductive materials, can do widespread damage.

SACKVILLE B. HOAG

Large motors and their controllers as applied to chemical plants are extremely important apparatus and must be designed, built, selected and installed properly to keep vital equipment running. The big motors are the percherons among industry's "workhorses" and are different from their smaller brothers in several respects. For example, they usually operate at higher potentials. Voltages of 2,300, 4,160, 6,900, and above, are employed for motors over 200 hp. Their design, lubrication, ventilation enclosures and structural materials also present special problems which must be approached in a custom manner by most manufacturers in the large motor business. The controllers of giant motors, although basically the same as for those in the smaller sizes, must necessarily be more extensive in motor supervision and

protection, since their value and importance to process is greater.

Large induction, synchronous and wound-rotor motors are being used extensively in the chemical industry, particularly in the heavy chemical group. They drive such equipment as:

Gas compressors
Air compressors
Gas circulators
Liquor pumps
Water pumps
Gas pumps
Air blowers

Air fans
Crushers
Grinders
Mixers
Pulverizers
Vacuum pumps

It is not uncommon today to consider use of motors of 5,000, 10,000 or even 25,000 hp. to drive huge gas or air compressors, crushers and pumps.

In almost all chemical plants there are one or more agents which, if not restricted or protected against, can cause the deterioration and possibly

failure of electrical equipment. Such failure may precipitate explosions or fires, causing serious property and production losses, or even loss of human life. In general these destructive agents include:

1. Moisture, i.e., water in form of dampness, humidity, fog, mist, spray, etc.
2. Corrosive vapors, mists, gases, salts, etc.
3. Explosive vapors, gases, dusts, powders, etc.
4. Electrically conductive dusts, powders, etc.
5. Abrasive dusts, powders, etc.

Unfortunately, many chemical plant processes involve several of these destructive agents. This makes defense against them extremely difficult and a challenge to the ingenuity of engineers and electrical manufacturers. For example, some metallic dusts and

LARGE MOTORS . . .

powders are abrasive, others conductive and explosive. Certain vapors may be both wet and corrosive, or both corrosive and explosive.

Heat Protection

Whether a motor temperature rating is 40, 50, or 55°C., it is good practice to monitor the temperature of the stator winding of large motors by insertion of temperature detectors in the winding. Usually there will be six detectors spaced at 60° intervals around the stator periphery. The temperature of each zone is checked by manually switching each detector in turn to an indicating instrument. The detector in a "hot spot" area is usually left connected to the instrument for close supervision. Such temperature monitoring is considered good insurance against failure of motors of about 500 hp. and above, although motors of lower horsepower also may employ this temperature check, depending on their relative value and importance to the process.

Bearing lubricating oil of big motors, and the bearings themselves, should have a constant temperature check by thermometers, thermocouples or the like. In very large sizes it is desirable to have audible or visible signals, or both, operating near the danger point of lubricant or bearing temperature. There should be disconnection of the motor at a predetermined high temperature limit.

Moisture Protection

It is considered good engineering in many motor applications—especially those involving larger ones—to place a number of electric space heaters inside the motor at strategic points between rotor and stator. These will prevent moisture condensate damage to the motor windings and metal parts while idle. The heaters can be energized (when motor is disconnected) either manually or automatically. The latter method, with thermostatic control, is preferable to avoid possible overheating of the motor should high ambient or solar heat temperatures prevail.

Electrical winding, slip-ring and brush rigging insulation should be non-hygroscopic. The use of dense,

high-temperature silicone varnishes, resins and similar compounds for bonding such materials as asbestos, mica, and glass fiber, can usually overcome this fault.

Totally enclosed, fan-cooled (TEFC) enclosures are suitable on all motors to combat moisture in any form. However, in very large synchronous, induction or wound-rotor motors, this type of enclosure is usually too costly. Hence, the chemical industry now frequently uses totally enclosed pipe- or duct-ventilated enclosures, or well-designed weather-protected, splash-proof or drip-proof enclosures, depending on the location and the degree of wetness to which the motor will be subjected.

Corrosion Protection

Corrosive mists and dusts are closely related to moisture, that is, many gases, vapors, and dusts have to be moist to start corrosive action on motor insulation and metal parts. Thus, enclosures that are suitable to combat moisture are largely similar to those used against corrosive agents. The

essential difference is that where corrosion is much more severe than ordinary rusting, metals such as stainless steel and aluminum, or molded plastics, may be required on certain parts of the motor. In such a case the winding insulation must be decidedly of the "chemical plant type" to prevent its physical and dielectric failure.

In corrosive atmospheres, slip-ring enclosures which are force-ventilated from a clean air source are often used as a compromise on large synchronous motors to avoid the high cost of enclosing the entire motor. The insulation leads, stator and field coils in this case should be of exceptionally high chemical- and abrasion-resistant quality to make up for lack of enclosure. Paints selected for motor frames should be able to withstand strong alkalis and acids, dust abrasion, etc. Light-gage metals should not be used in baffles, terminal boxes, and the like.

Explosion Protection

As noted in the comments below on the National Electrical Code, the problem of hazardous conditions is perhaps one of the most discussed subjects in the chemical group. When the electrical engineer selects and applies large motors in various hazardous areas, he must keep the initial cost low, yet at the same time select a motor that will resist fire or explosion.

Explosion-proof NEMA frames for any of code Classes I, II, or III hazards become costly and often impracticable to fabricate for large motors. Provided they are well designed, totally enclosed, pipe-ventilated (TEPV) enclosures for forced-air cooling, or totally enclosed, water-cooled (TEWC) enclosures, are excellent substitutes. In the TEPV type, the intake air must be free of any hazardous gas or dust contamination. Air pressurizing of the motor enclosure is mandatory, to preclude the access of explosive gases and dusts through any enclosure apertures. Motor winding and other lead exit points should be well sealed with a suitable compound, or baffling.

As in corrosive atmospheres, many large synchronous motors in mildly hazardous areas have clean-air-purged slip-ring compartments to resist gas



S. B. HOAG took his degree in electrical engineering at New York University College of Engineering in 1932. He went initially into power generation, transmission and application, but later specialized in electrical engineering applied to chemical plant work. Since 1936 with Chemical Construction Corp. in New York, he now heads the Division of Electrical Engineering. His electrical engineering and construction responsibilities have extended to many chemical plants here and abroad.

During NYU's recent 100th Anniversary celebration, Hoag was cited for outstanding achievement, as one of a group of 100 engineering graduates so honored. Hobby-wise, he is known among amateur painters for abilities in both water colors and oils.

Special Protection Recommendations for Large Motors Used in Chemical Plants

Key to Enclosure Types		Key to Protective Features		
DP, drip proof; EP, explosion proof; OM, open motor; SP, splash proof; TEFC, totally enclosed, fan-cooled; TEPV, totally enclosed, pipe-ventilated; TEWC, totally enclosed, water-cooled; WP, weather protected.		(1) With clean or filtered air intake. (2) In clean-air-pressurized compartment or room. (3) Space heaters in motor enclosure to combat moisture or dampness. (4) Inert-gas filled. (5) Efficient air-cleaning and washing or filtering system. (6) Enclosed slip rings, commutator and brush compartment; clean-air purging and pressurizing preferred.		
Ambient Conditions	Usually Found in	Recommended Protection Indoors	Recommended Protection Outdoors	Special Features Recommendations
Corrosive Sprays, mists, vapors, gases, flakes, crystals, power dusts, etc.	Saltwater pumping or locale Chemical handling or mfg. of: Acids: sulfuric, nitric, acetic, hydrochloric, etc. Alkalis: hydroxides of Na, K, NH ₄ , etc. Salts: ammonium sulfate, ammonium or calcium nitrate, calcium chloride, etc.	TEFP TEPV (1) DP, OM, SP (2)	TEFC WP	Corrosion and moisture resistant insulation, metal parts, paints, coatings. (3)
Explosive, Flammable Gases, vapors, mists, fibers, crystals, flakes, dusts, powders, etc.	Chemical handling or mfg. of: Gases: acetylene, hydrogen, natural or mfd. gas. Liquids: alcohols, benzene, turpentine, etc. Dusts: S, C, plastics, grains, metals such as Al, Fe, Mg, organic fibers, lint, etc. Explosives: Ammonium nitrate, etc.	TEFC Explos. TEWC (4) TEPV (1) DP, OM, SP (2)	EP TEFC if remote from hazardous zones. WP if remote from hazardous zones	Moisture resistant insulation (5) (3)
Abrasive Powders, dusts, crystals, flakes, etc.	Chemical handling or mfg. of: Coal, coke or general carbon dusts Bauxite, limestone, alum, etc. Metallic dusts such as Fe, Al, brass, etc. Silicate powders, dusts, sand, cement, etc.	TEFC TEPV (1) EP TEWC (4) if dust is hazardous DP, OM, SP (2) (6)	TEFC WP	Abrasion resistant insulation, metal parts, paints, coatings. (5) (3)
Electrically conductive Powders, dusts, crystals, flakes, scales, etc.	Chemical handling and mfg. of: Carbon black, graphite, coke or coal dusts Metallic dusts such as Cu, Sn, Fe, Al, Ni, etc.	TEFC TEPV (1) TEWC (6)	TEFC WP	Abrasion resistant insulation, metal parts, paints, coatings. (5) (3)

or dust explosions. Heavy cast-steel or iron enclosures without blowers are being introduced by some manufacturers as a compromise to cover the slip rings, although this should be approached cautiously owing to possible formation of ozone or NO.

In some installations, wound-rotor slip-ring motors and their control resistors are ventilated and pressurized. With good preplanning outdoor weather-protected motors can be kept away from vessels which hold explosive liquids or emit dangerous gases. With good outdoor ventilation, the requirements of the National Electrical Code and of insurance inspectors can usually be met, and TEFC or TEPV motor enclosures may be avoided.

Sound analysis and judgment by engineers and underwriters must be em-

ployed in many installations, since ventilation, proximity to other equipment, barriers, weight of explosive gases, height of building, and other factors, all influence equipment arrangement.

National Electrical Code

In the electrical design of chemical plants the National Electrical Code is referred to by most electrical engineers in the chemical group, and serves as an excellent guide to promote durable and safe electrical equipment, materials, and workmanship.

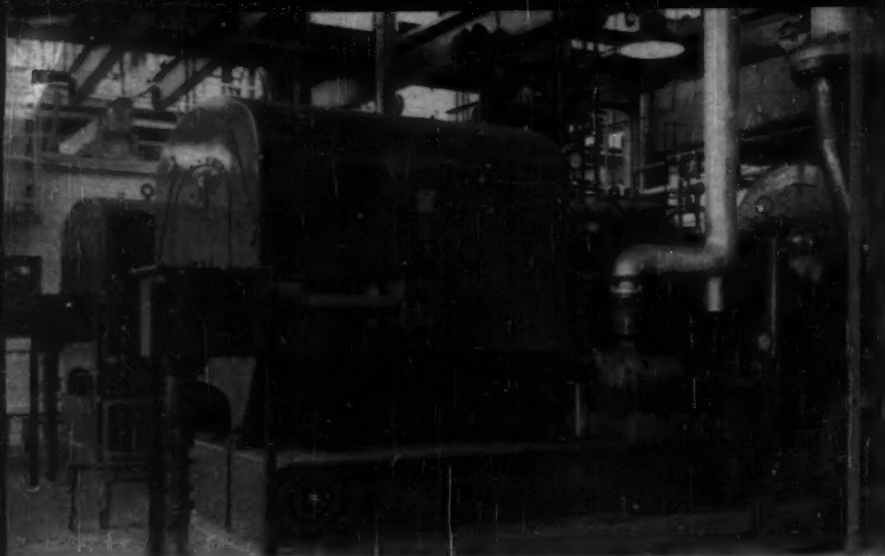
As concerns moisture, corrosion and abrasion, the engineer must use good judgment since he is fully on his own in overcoming these evildoers. But, when it comes to hazardous conditions, the Code specifications of Chap-

ter 5, Article 500, Sections 5001 to 5087, should be consulted and adhered to as closely as practicable.

The fact that chemical plants are increasing in size and constantly producing new chemicals—many of which may fall in the danger range—presents an ever-growing problem of classifying these chemicals into recognized hazard groups.

Obviously the Code cannot specifically cover every material and condition arising. Thus, it is imperative that the engineer must first know exactly what are the potential dangers of each new vapor, dust or gas he is dealing with. Then he must attempt to classify it accordingly, referring to Code Section 5004.

In choosing enclosures and locations for large chemical motors and



WEATHER PROTECTION is provided for these 1,500-hp. outdoor squirrel-cage induction motors by protective steel housings and a special ventilating system.

controllers in particular, there is need to correlate common sense, good engineering judgment, economics and practicability, with the National Electrical Code basic rulings and the interpretations of Insurance Underwriters. It must be recognized that the large chemical plants of today introduce special problems in hazards, safety and insurance, and that a reasonable compromise of the Code and insurance requirements is often the only answer.

Weather Exposure

Where climatic conditions permit, there is a growing trend in large chemical plant design to install a great deal of the equipment outdoors. Superstructure costs are materially reduced in this way. Only a few weathertight buildings or housings are required to protect special equipment, and control panels and instruments against the elements. It follows that exposed motors and starters must be weather-protected in such plants.

Placement of much equipment outdoors in chemical plants has influenced interpretation of the Code to some extent. Very good natural ventilation is present and hazards which would exist indoors through "pocketing" of hazardous vapors and gases, are practically non-existent outdoors.

Controllers

The performance of any size motor in a chemical plant is determined to a great degree by the controller components which govern its behavior and

protect it thermally and electrically. Starting controllers for large motors are essentially the same as those for medium and small motors. In larger machines, however, higher motor voltages are encountered and the motor represents a large capital investment. In addition, it probably is meeting a vital process duty. It follows, therefore, that a greater number of devices is necessary in the large motor controller, to start and accelerate the electrical driver, and place it "on the line" with a minimum of trouble. It must be protected by these accessories and monitored by instruments throughout the various states from static to load conditions.

Induction Motor Control

Short-Circuit Protection—This is obtained either by high-interrupting-capacity fuses, or by circuit breakers employing fast relays or built-in instantaneous tripping devices. It is necessary to disconnect the motor from the line as quickly as possible should the motor current exceed its locked rotor or maximum starting value. Control contactors of 10 times normal current interrupting capacity or less should always be "backed up" by high-interrupting fuses or breakers, if they are connected into a system capable of delivering current during a short circuit of over the 10 times the normal value.

Overload Protection—This is necessary in large motor controllers and differs from short-circuit protection in that an inverse-time characteristic is present. In short-circuit protection, disconnection is necessary immedi-

ately. Inverse-time overload protection merely signifies that the larger the current caused by mechanical load, low voltage, single phasing or high-resistance internal motor faults, the shorter the time interval before tripping. The reverse condition holds also. Overload relays may be of the thermal overcurrent type (i.e., influenced by ambient temperatures), or they may be of the straight overcurrent type. The first class is usually preferable as ambient temperature is considered, and this is an important factor in motor thermal loading. In the final analysis temperature limits the work capacity of a motor.

Undervoltage Protection—In the control of the bigger motors, it is important that voltage loss or dips on the power system feeding the plant either disconnect the motor instantaneously, or after a predetermined time-delay interval. The time-delay method is used quite frequently in big chemical installations for very large and vital process motor control to avoid unnecessary manufacturing outages.

Instruments—An a.c. ammeter is usually employed to supervise the performance of large induction motors. Optional meters are a watt-hour meter or a wattmeter (or both), to check specific machine energy consumption, or to determine departmental billing, and the like.

A temperature indicator used with a selector switch and at least six imbedded stator temperature detectors is good engineering practice. This allows checking the thermal behavior of large motors and thus avoids electrical insulation failures due to mechanical overloading, cooling system failure, or other causes.

Space-Heater Control—The electric space heaters in motors previously discussed, are energized when the motor is disconnected from the line, using auxiliary contacts on the main a.c. stator breaker or contactor, or by means of relays.

Bearing and Lube Oil Supervision—Audible or visible signals, or both, are recommended for supervision of bearing temperature and lube oil pressure of large motors. It is advisable first to have the operator warned at a predetermined dangerous temperature or pressure, and then disconnect the mo-

tor automatically if adverse conditions are not immediately rectified following the signal.

Synchronous Motor Control

Large synchronous motors are often used in chemical plants to gain high-power-factor benefits, first-cost economy resulting from low-machine speeds, or to meet fixed speed requirements. Their controllers are similar in many respects to those for induction motors. However, because of their synchronous nature, additional protective devices and instruments are necessary.

Short-circuit, overload and under-voltage protection, space-heater control, stator thermal protection, oil pressure and bearing temperature monitoring are essentially the same as for induction motors. Here, an a.c. ammeter is recommended, with wattmeter or watthour meter optional.

Out-of-Step Protection—A synchronous motor falling out of step will eventually be disconnected from the line by overload relays, but it is good practice to back up the out-of-step relay with overload relays or a similar accessory which will stop the motor quickly should the synchronous motor fail to accelerate to "pull-in" speed in a given time, or drop out-of-step while running.

Excitation Control—Since large synchronous motors must have external d.c. excitation, either by means of a rectifier, battery, direct-connected or motor-generator exciter, additional devices are required with the a.c. gear to insure proper application of this d.c. excitation to the motor field or rotor. These accessories consist of field contactor timing or field application relay, main motor field or exciter field rheostats, or both, field discharge resistor, motor-generator set motor starter, etc.

The additional instruments recommended beyond those listed previously for induction motors, include a d.c. ammeter for field current supervision and power-factor check, and a power-factor meter.

Field Application Control—To apply and control the field excitation of large synchronous motors, field application panels or cubicles are quite often divorced from the main a.c. stator switchgear. Where conditions

permit, these field panels are usually placed near the synchronous motors. Mounted on them are all instruments, field application equipment such as field contactor, discharge resistors, push buttons, signals and other d.c. field accessories. The stator switchgear, comprising breakers or fuse-backed-up contactors, can in many cases be incorporated as part of a main outdoor or indoor sub-station switchgear assembly, at a point remote from the motors.

Control Location and Enclosures

As it is not usually practicable in the chemical industry to construct controllers of cast iron or cast steel for large motors, the electrical breakers, contactors, high-interrupting fuses, and other components, are usually enclosed in cubicles of stretcher level type steel, designed with either general-purpose, dust-resistant or weather-resistant enclosures. These controllers do not have the variety of enclosures that are made for motors for corrosive, wet, dusty, or hazardous conditions. Hence, their location with respect to the contaminated area is often as important as the enclosure design itself.

In indoor areas that are not to any great degree abnormal, these controllers are placed singly or in groups, adjacent to one or more of the large motors they govern. Where corrosive or explosive agents are serious, the cubicles should if possible be moved to a point safely remote from the danger zone. If location near the motors is still required, as is often the case, then these controllers should be placed in a pressurized room with an internal air pressure of 0.2-0.5 in. H₂O. The room should have a gas-tight safety window between the process area and the controllers, to permit signaling between operators and observation of the driven equipment. The incoming air to this room should be made as free as possible from contaminants, by locating the intake air duct entrance at a point in the plant where clear and fresh air is available. Filtering, and in extreme cases washing, neutralizing and even drying of the air before discharge into the room, is advisable. Air locks should be provided between the contaminated area

and the controller room. Still better, the entrance to this room should be through an outside wall or, at least, one that is not common to the control room and the process area.

Care should be taken not to permit damaging agents to enter this room through electrical conduit or duct systems, by employing conduit seal-off fittings or similar barriers. In this type of room a general purpose enclosure is quite sufficient for electrical control. Where other switchgear, exciter sets for synchronous motors, or wound-rotor resistors and drum controllers are required, these too can be located in the same room without special enclosures.

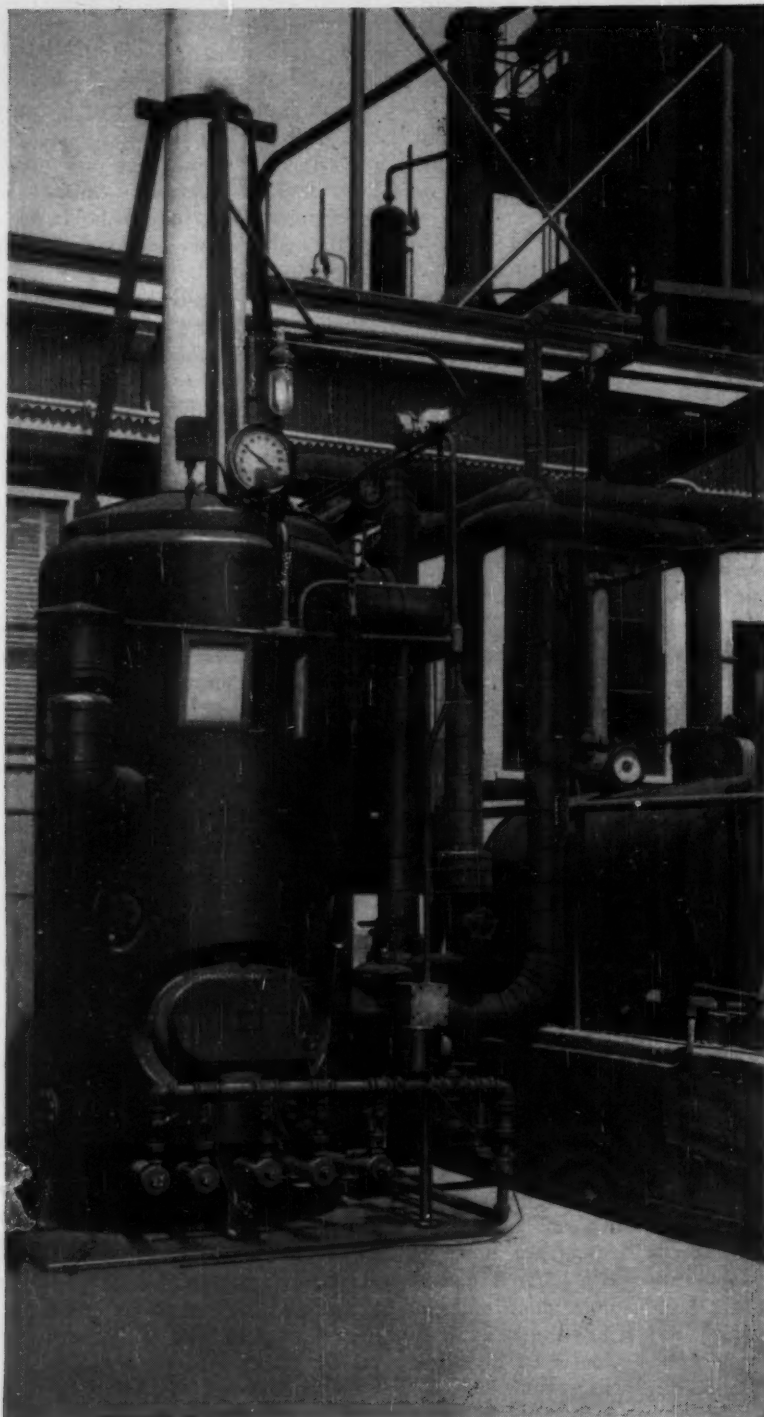
In outdoor installations where hazardous and corrosive conditions exist, the controller cubicles or housings should be located to the best advantage to eliminate infiltration of dangerous gases and damaging vapors. The direction of the prevailing wind, the density of gases, proximity to stationary and moving equipment, and similar factors should be carefully checked in determining the final arrangement.

Now that outdoor installation of chemical equipment is becoming increasingly popular, a weather-protective or weather-resistant controller cubicle design is necessary. One or more controller cubicles in outdoor installations can be enclosed inside a single weather-resistant steel housing or masonry building, with lighting and space therein to permit servicing, maintenance or inspection during inclement weather.

In ventilating indoor or outdoor enclosures, stainless steel or similar non-corrosive screening should be used on intake and discharge openings to prevent entrance of birds, insects and rodents. Glass or stainless steel oil-coated wool should be used for air filters on intakes where dust exists. On outdoor cubicles, in addition to the preceding, louvers should be used on openings to prevent the entrance of driving rain.

Electric space heaters, which may be thermostatically or differential-temperature controlled, are advisable in controller cubicles or housings, to prevent condensate accumulation and subsequent corrosion damage through high humidity and rapid ambient temperature fluctuation.

What^{Not} to Do With Dowtherm Systems



DOWTHERM SYSTEM with Eclipse vertical fire-tube vaporizer.

The best way to learn is always from someone else's mistakes. Let these samples serve you in design.

W. L. BADGER

I've always believed that a study of failures furnishes valuable assistance in the design of equipment. Fortunately failures seldom occur and unfortunately, this source of information is not always easy to come by.

In the course of many years' association with the applications of Dowtherm we have run across a few failures and it seems desirable to put these on record as a guide. Some of them are such obvious errors that they seem quite pointless in the reading. But it is easy to be wise after the event.

The writer believes that he helped to engineer the first plant to use diphenyl or diphenyl oxide as a commercial-scale heating medium in the United States. This was a series of vacuum stills built for the Indian Refining Co., Lawrenceville, Ill. The stills were heated with diphenyl because at that time the eutectic mixture of diphenyl and diphenyl oxide—now known as Dowtherm A—had not been developed. Commercial applications of Dowtherm began in 1931 and grew slowly during the first few years. Today there are about 1,500 commercial Dowtherm installations in the United States, and this figure is probably on the low side.

Dowtherm is so well accepted as a method of heating—and in many respects seems so simple—that there is a temptation for persons unfamiliar with it to design systems without fully investigating all the special features required. While some of these systems have been successful, many of the failures that we'll describe here fall into this group. Surprisingly enough, some of the failures have

been due to mistakes made by perfectly competent engineers who should have known better.

We believe that since out of between 1,000-2,000 commercial installations and more than 20 years of experience so few failures have occurred it argues very well for the excellence of engineering that has been generally applied to Dowtherm problems.

While the following cases are not all that have come to my attention, they are the most instructive ones. However, an exhaustive list of failures small and large would probably not be more than three times the list in this article.

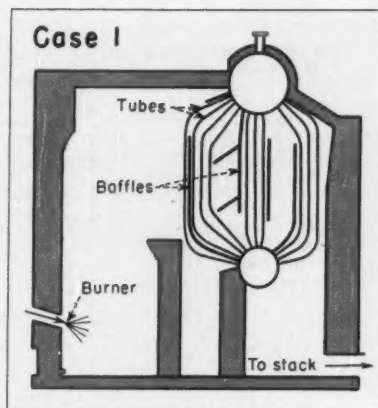
1 Company A was operating a fatty-acid distillation system in which the feed to the column was preheated in a tubular heater. The Dowtherm vaporizer was an early design, baffled roughly as shown above. There was no Hartford loop in the return condensate line.

The vapor drum of the Dowtherm vaporizer had been so calculated that if the valve at the inlet to the heater were closed and a vacuum produced, the amount of Dowtherm needed to fill the heater shell completely would still not lower the Dowtherm level in the top vaporizer drum by a dangerous amount.

However, after the equipment had been in operation for some time, additional heaters were installed. Apparently all were not operated at once. Either because of this, or through negligence in operation, the vaporizer ran for a considerable time with no level visible in the gage glass. How low it got, there is no telling.

The baffling in the vaporizer was such that the hottest gases hit the tops of the tubes where they might go nearly dry if there were a low Dowtherm level. Apparently this happened. The tubes filled with carbon at the top and failed. The failure extended far enough down the tubes so that the charge of Dowtherm dropped into the firebox and burned.

I was in the boiler setting 24 hours after the fire and found nothing much left of the vaporizer except some masses of melted metal. Enough stubs of tubes were found connected to the top drum so that we could reconstruct what had happened.



The vaporizer was equipped with a damper in the stack and with steam-smothering equipment in the firebox. The operator found that the damper was rusted tight and could not be moved. He turned in a plant fire alarm.

The plant had a rule that whenever a fire was reported steam was to be shut off completely from that building. Therefore, the steam-smothering connections were inoperative. The burning Dowtherm vapors went up through the relatively short stack and dropped onto the roof (wood, covered with tar). The roofing burned and caused considerable damage. At the level of the vaporizer there was no serious damage, except that the instrument panel was badly scorched by radiant heat.

LESSONS

- Presence of a Hartford loop would have prevented the heaters robbing the vaporizer of Dowtherm. This is standard practice today. Most serious error was in running the vaporizer for a considerable length of time with no level in the gage glass. Today, we would consider this inexcusable. At present all makers of Dowtherm vaporizers supply them with low-level alarms and low-level fuel cutoffs.

- The vaporizer should have been baffled so that the hottest gases did not strike the front row of tubes at the top. This is usually done today.

2 A European plant had distillation equipment intended for some rather high-boiling oils. They decided to replace the circulating hot water coil with circulating liquid Dowtherm.

After the necessary equipment was installed, they tried the system out and found some minor leaks.

They drained the system but did not wash it free from Dowtherm. The leaks were repaired by welding. This in itself is not hazardous when there is a free vent for the Dowtherm vapors. However, after the welding, they had to test the system. Ammonia is usually used.

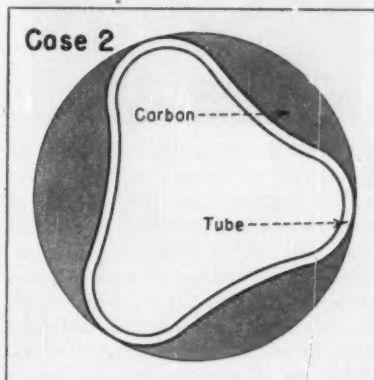
The workmen could not find an ammonia cylinder and hooked up the welder's oxygen cylinder instead. There was an immediate violent explosion that wrecked the plant and killed three men.

The chief chemist of the company, who was supervising the operation, and a representative of the firm making the changes were both killed. So there is no way of telling who was responsible. I saw the installation exactly as it was after the explosion. Where parts had broken, the surfaces were not fractured but fused. All of the damaged parts showed clearly that failure was due to the fact that the iron had burned in oxygen.

LESSON

- It should be a matter of common knowledge that pure oxygen should be kept away from any equipment that has even the slightest trace of organic material on it.

3 Company C wished to go into the manufacture of small vertical fire-tube Dowtherm vaporizers. They were given as much information about Dowtherm as was at the disposal of the Dow Chemical Co. To encourage them Dow purchased a small unit for use in the pilot-plant laboratory. Within a few months the vaporizer



DOWTHERM SYSTEMS . . .

was on the scrap heap. Investigation of the bottom tube sheet showed the condition indicated in the sketch.

Company C knew that tubes in such a vaporizer should be seal welded to the tube sheet. They came to the conclusion that since this weld must be tight to Dowtherm, careful rolling of the tubes into the tube sheet was not necessary.

Evidently there had been a microscopic clearance between the tubes and the tube sheet. Dowtherm—with its extraordinary ability to wet metals—had penetrated this opening. Since this was in the bottom tube sheet and exposed to flame temperatures and since there could be no circulation, the Dowtherm in the cavity decomposed. This formed carbon. The carbon was porous, absorbed more Dowtherm and there was still further decomposition. Eventually the carbon deposit grew to such an extent that it crushed the tubes.

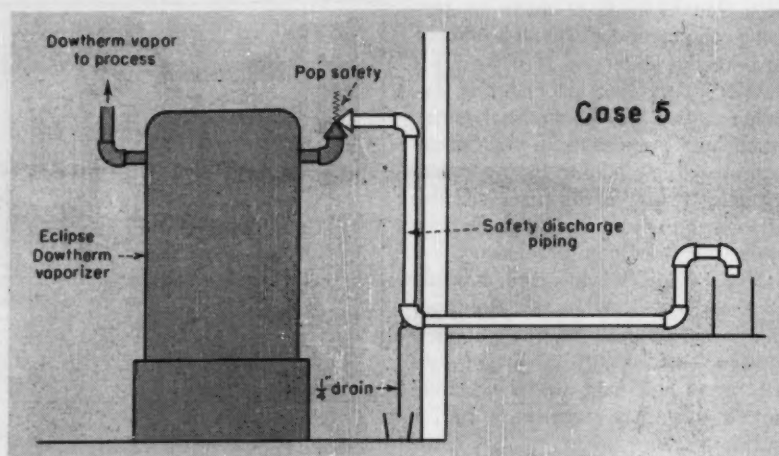
LESSON

- Only the very best workmanship is permissible in a Dowtherm system especially in vaporizers.

4 Company D wished to prepare a special grade of starch paste by drying a starch slurry at very high temperatures. They had chosen Dowtherm



WALTER L. BADGER really needs no introduction to chemical engineers. Renowned authority on the subjects of evaporation and Dowtherm, he is head of his own consulting firm in Ann Arbor, Michigan. In addition to authoring this article and co-authoring the two-part salt processes article in our March and April issues, he is currently preparing a revision of his text on fundamentals.



temperatures between 450 and 475 F. This corresponds to a vacuum of 10-14 in. The drying roll was the usual cast-iron roll, 4 ft. dia. by 6 ft. long.

This meant that Dowtherm condensate had to be lifted about 2 ft. to get it up to the trunnion of the roll. Here it went through the usual stationary pipe passing through a stuffing box in the trunnion. But they found it impossible to get condensate back to the vaporizer.

In the first place, the stationary pipe passing through the stuffing box was found to be 0.02 in. out-of-round. Also, the stuffing box called for 14 rings of 1-in. square packing. But the gland was only about 3 in. long. It was impossible to compress the lower rings.

Third, the condensate was supposed to be sucked out and returned to the boiler by a simple ejector (not an injector) actuated by Dowtherm vapor from the vaporizer itself.

The first job, of course, was to machine the stationary condensate pipe where it passed through the stuffing box, to modify the stuffing box so that it only took 6 to 8 rings of packing. Then we devised an auxiliary split ring to go below the gland and compress the packing ring by ring as it was put in. The second job was to provide a condensate receiver just outside the drum with a steam-jet ejector that would produce a much higher vacuum than that desired in the drum.

Level controls in the receiver provided that when the receiver was filling the ejector was in operation and a check valve between the receiver and

vaporizer was supposed to be closed. When the condensate receiver filled, a float tripped contact switches that cut off the ejector. This equalized the top of the condensate receiver to the vaporizer. Then condensate could drain back into the vaporizer by gravity. The condensate receiver was set 10 or 12 ft. above the vaporizer so that there was ample head to open the check valve. Still the system would not work.

On investigation we found the check valve to be full of metal chips. Further investigation showed that the vaporizer (a homemade horizontal-return tubular affair) had a layer of metal chips, rags, wood shavings and miscellaneous dirt about 6 in. deep in the bottom. After the vaporizer and the lines were cleaned out, the system functioned entirely satisfactorily.

LESSONS

- Sloppy workmanship cannot be tolerated on any Dowtherm job.
- A Dowtherm system must be clean and free from scale and metal chips, especially if check valves are in critical positions.
- Devices that would be unsatisfactory on a steam job (the use of a simple ejector instead of an injector) are equally inoperative on a Dowtherm job.

5 Company E was operating an Eclipse vertical fire-tube Dowtherm vaporizer. The floor of the vaporizer room was slightly below the ground outside. The discharge pipe from the safety valve was carried horizontally,

then vertically down and out of the building at ground level.

Because pop safety valves on Dowtherm often leak, the line was continued horizontally along the ground and then rose into a gooseneck to discharge into a drum. To guard against possible stoppages in the horizontal run due to freezing, a small hole was drilled in the heel of the ell in the vaporizer room and drained into a bucket (see cut). The condensation from the leakage of the safety valve was thus collected and from time-to-time returned to the system.

On one occasion the pop safety blew. There was enough friction in the discharge line from the pop safety so that a mixture of Dowtherm vapor and liquid was ejected from the drain into the vaporizer room and caught fire. The fire traveled back through the drain and into the safety valve discharge line.

The operator became rattled and turned a cold water hose onto the vaporizer. This produced a vacuum in the vaporizer that sucked back burning vapors from the pop safety discharge (the pop safety had not resealed) so that a fire was burning in the vapor space inside the vaporizer. In a short time this produced enough pressure in the vaporizer to blow burning vapor out through the safety valve discharge line. The whole process was repeated.

By the time this had happened two or three times, the vaporizer was pretty thoroughly wrecked.

LESSONS

- No possibility should exist of the discharge from a pop safety reaching the vaporizer room.
- Discharge piping from a pop safety should be either ample in size or short enough in run so that it causes a negligible back pressure.

6 Company F operated some high-speed printing presses and decided to try a blast of air, heated to a high temperature with Dowtherm vapor, for drying the ink. They refused to listen to any advice about Dowtherm, and called in an engineering concern that had no experience whatever.

A small pilot installation was built with a vertical fire-tube Dowtherm vaporizer. The pop safety valve was

attached directly to the vaporizer shell with the discharge pointing down.

One morning the operator wanted to get started in a hurry, fired the vaporizer as fast as possible and blew the pop safety. This naturally resulted in blowing Dowtherm vapors directly into the entrance to the fire box. The vapors caught fire. The plant burned down.

LESSONS

- Dowtherm installations should be engineered by someone who knows about Dowtherm.
- Pop safety discharge should always be led out of the building in which the vaporizer is installed.

7 Company G was operating a process for deodorizing edible oils using Dowtherm heat. The Dowtherm vaporizer was rated at 3,000,000 Btu./hr. Two or three tubes in the front row of the vaporizer burned through. Dowtherm leaked into the combustion space and caught fire. The operators did not get panicky, took the necessary steps to extinguish the fire and no harm was done either to the vaporizer or to the plant.

I inspected the vaporizer within a relatively short time and all indications seemed to point to an overload. It was possible that control instruments had not been responsive because

the packing glands on the valve stems had been drawn up too tight in order to stop Dowtherm leaks. But it still seemed that there must have been an overload. So far as the plant management was concerned, they could not account for any overload. And the cause of the failed tubes remained a mystery.

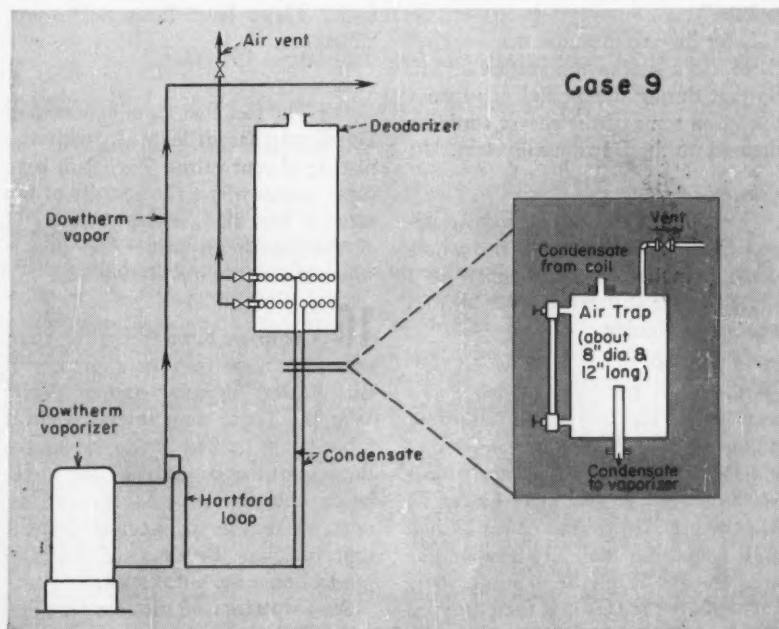
Some months later—purely by accident—a representative of the company that supplied the gas burners for this vaporizer told us that he had been asked to put larger orifices in the gas line feeding the burner; and the burner had a revised capacity that would have allowed the vaporizer to deliver over 4,000,000 Btu./hr.

After the proper-sized orifices were reinstalled and the vaporizer kept below its rating, no further trouble developed.

LESSON

- Dowtherm vaporizers must not be operated appreciably above their ratings, even for relatively short times.

8 Company H operated kettles in which greases were made. The kettles were heated with Dowtherm jackets and had been in successful operation for some time. Finally the Dow Chemical Co. received a complaint that a lot of bad Dowtherm had been shipped to Company H and it was causing



DOWTHERM SYSTEMS . . .

foaming in the Dowtherm evaporator.

Inspecting the plant, I noticed that the appearance of a sample of the Dowtherm condensate was all wrong. We made a simple Engler distillation of the sample.

During our distillation about 10% came over in the boiling point range of the kerosene being used. The distillation temperature then rose to the boiling point of Dowtherm and the bulk of the sample came over at this point. When the Dowtherm distilled off there was a non-volatile residue left in the flask. A strong odor of acrolein indicated that the residue was probably linseed oil.

We insisted that there was a leak from the kettle into the jackets, but were assured that this could not be the case. And, at any rate, even if there had been a leak the pressure of Dowtherm in the jacket was always 15 to 20 lb. If there had been a leak it would have forced the Dowtherm into the charge and not the other way around.

The matter was argued for a long time, but no holes could be found in this line of reasoning. Later in the day in talking with one of the operators, I asked him about the pressure in the jackets and whether it ever fell below atmospheric.

He said, "Oh, of course, when we have a fresh cold batch in the kettle and first turn on the Dowtherm we get a vacuum of 10 to 15 in. in the jackets."

Later investigation did disclose that there was a leak in the kettle bottom. So that during this period of vacuum operation some of the charge could be drawn into the Dowtherm system.

LESSON

• Conditions during regular operation do not always tell the whole story. Sometimes things happen for a short time or at irregular intervals that may cause trouble.

9 Company J had just started a new installation for the deodorization of edible oil. The deodorizer consisted of a vertical tank with two pancake coils in the lower part that were heated by Dowtherm. The vaporizer was located well below the tank. The vapor line rose straight from the vaporizer to a point above the tank and then dropped

to a header that fed the two coils. Condensate was returned by gravity through a Hartford loop and there was ample head for the return.

It was found impossible to bring the oil up to deodorizing temperature even after forcing the vaporizer to its highest temperature for several hours.

The writer found that the only air vents were at the top of the system as shown in the sketch above. The Hartford loop provided a seal at the bottom of the condensate system and there was no possible way to eliminate the air in the coils. Instructions to the company by the manufacturers of the equipment were to the effect that since air is lighter than Dowtherm, the air vents should be at the top.

Since air is insoluble in liquid Dowtherm, and since such a system operates in a closed cycle with hot Dowtherm never exposed to air, the vapor leaving the vaporizer could never contain more than a microscopic percentage of air. With the air vent valves in the position shown, the only way to vent air from the system would be to vent the entire charge of Dowtherm.

This would only remove air from the vaporizer and could not affect the air in the coils. I suggested the installation on the condensate line of an air trap. They called me by long-distance phone the next day and reported that after the vent connection had been installed, the charge reached full temperature easily in a very short time. There have been no further difficulties.

LESSON

• The fact that air is lighter than Dowtherm has little to do with the placing of vent valves. Except in large vapor spaces where the velocity of the vapor is low, air is washed to the end of the Dowtherm path. And that is where the air should be removed.

10 Company K was operating some very large vaporizers in a process of the greatest urgency during World War II. There were several cases of tubes being burned out in vaporizers. Because of the large size of the installation, the time necessary to cool the unit, make the repairs and get the unit back on the line, the losses of production were intolerable.

An inspection of the situation and

extended discussions with the operating staff led to certain modifications in the vaporizer design that seemed desirable; but hardly accounted for the serious difficulties that had been met in operation.

After a considerable length of time, it was finally reported to us that the charge of Dowtherm had been shipped to the plant before the vaporizers were completed. It had been necessary to rent some storage space to hold the Dowtherm until the vaporizers were ready for it. This storage space had been used for heavy oil, and the first vaporizer put into service was charged with material from this storage.

The other vaporizers in the plant each had less and less of this contaminated material. The first vaporizer—which had been charged with the dirtiest Dowtherm—had given the most trouble.

LESSON

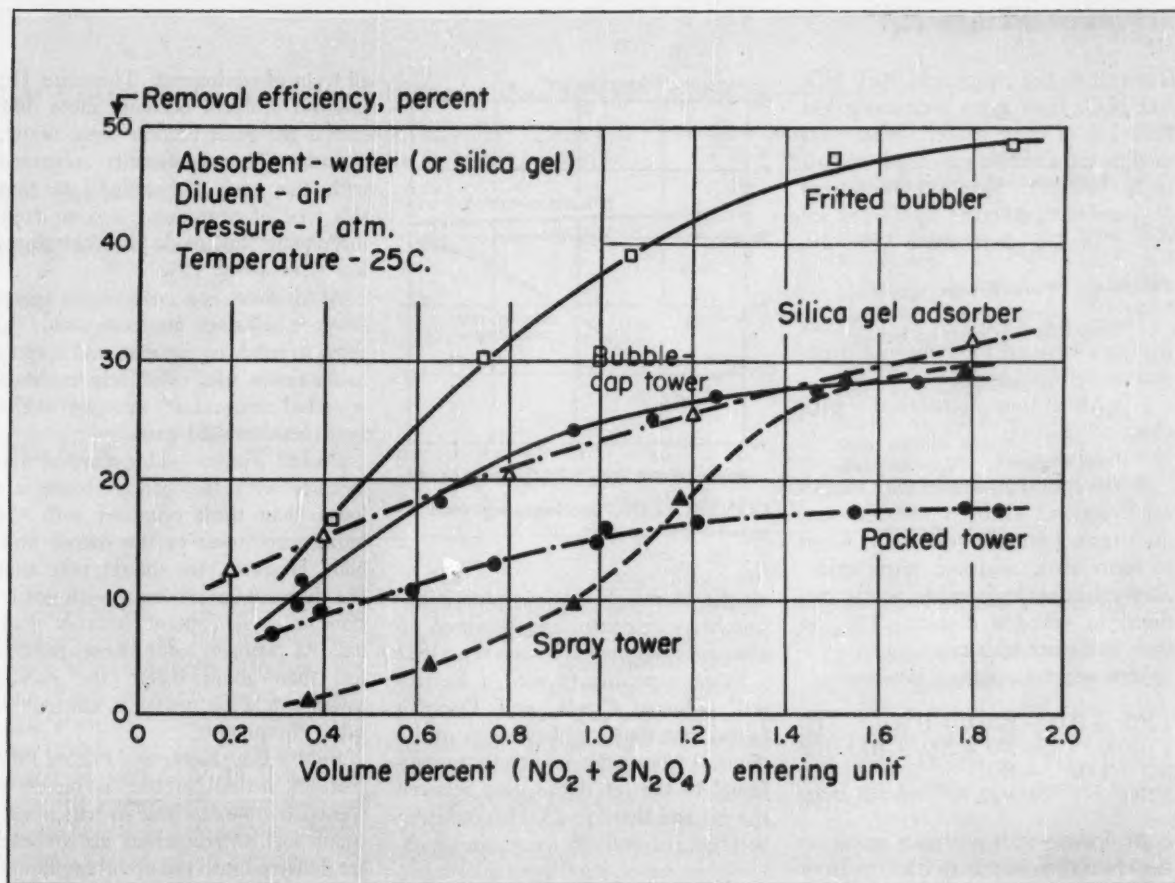
• Since Dowtherm is the stablest heat-transfer material we have yet found, it follows that almost any organic material that gets into Dowtherm will be less stable and will decompose in the vaporizer when heat is applied.

11 Company L was operating a process in which some of the equipment was heated with circulating hot liquid Dowtherm. The unit in which the Dowtherm was heated was a considerable distance from the unit in which it was used. The piping for the circulating Dowtherm passed down a long corridor that was used for equipment construction and in which there was an overhead crane.

The crane operator dropped a load which broke the Dowtherm piping. The stream was ignited from a welder's torch that happened to be in operation in the immediate vicinity. Since Dowtherm was being circulated with a pump, this resulted in a jet of burning Dowtherm liquid that caused considerable damage before the pump could be stopped.

LESSON

• Dowtherm is no more foolproof than steam, and if extraordinary accidents happen to a Dowtherm system it is not the fault of Dowtherm if damage results.



BUBBLE-CAP TOWER can give good removal efficiency at low concentration—(Fig. 1)

Stop Pollution by Nitrogen Oxides

If part of your air-pollution headache is caused by the presence of nitrogen oxides in effluent stack gases, here's the latest information on what you can do to combat it.

MAX S. PETERS

Many industrial processes evolve stack gases containing nitrogen oxides, usually in the form of nitric oxide or nitrogen dioxide. Some examples: nitric acid plants, chamber sulfuric acid plants, units for the regeneration of cracking catalysts and certain metal pickling operations.

To avoid atmospheric contamination—as well as for economic reasons—it's important to have efficient methods for reducing the oxide content of these gases to less than 0.2 volume percent, if possible.

Atmospheric concentrations of ni-

trogen oxides as high as 0.4 parts per million have been reported in the Los Angeles region. However, these oxides are seldom present to a sufficient extent to cause noticeable physiological effects. But nitrogen dioxide can react with the water vapor in the air or with rain drops to produce nitric acid. Even small concentrations in the atmosphere can cause undue corrosion on metal surfaces in the immediate vicinity of the releasing stacks.

Vegetation may also be damaged if the concentrations become excessive. In addition, the oxides of nitrogen

can increase atmospheric pollution in an indirect manner by catalyzing certain reactions such as the oxidation of sulfur dioxide.

In some processes nitrogen oxides must be removed from gaseous products before the gases can undergo further recovery treatment. An example of this is the recovery of radioactive rare gases evolved in the preparation of certain fissionable materials.

It is the purpose of this article to describe some work on effective methods for removing nitrogen oxides from dilute gases. Our investigation was

NITROGEN OXIDES . . .

confined to the removal of NO, NO₂, and N₂O₄ from gases containing less than 2% of these oxides. Water was used as the absorbing medium and air as the diluent. Removal efficiencies obtained with different equipment are shown in the chart above (Fig. 1).

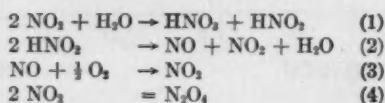
REMOVAL PROCESSES

There are two general processes that can be used for removing nitrogen oxides from gases:

- Absorption combined with chemical reaction.
- Adsorption.

In absorption combined with chemical reaction, nitrogen dioxide and dinitrogen tetroxide react with water to form nitric acid and nitric oxide. The nitric oxide formed can be oxidized to nitrogen dioxide. This, in turn, can react with more water.

Here are the reactions involved:



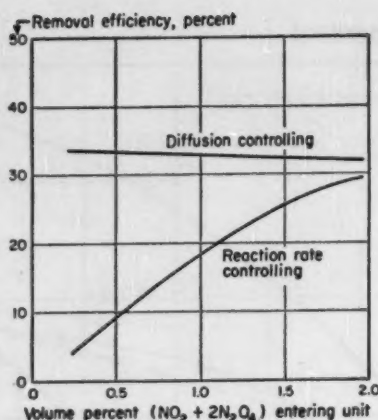
In dealing with processes involving the absorption of nitrogen oxides from dilute gases it's important for us to know if the rate of absorption is controlled by diffusional resistances or by the rate of the chemical reactions involved. Fig. 2 shows how the controlling mechanism governs the removal efficiency.⁷

We define removal efficiency here as the percent of the entering oxides that are removed from the gases. If diffusion is controlling, a reduction in the entering oxide concentration will affect the removal efficiency only slightly. However, if the reaction rate controls, the removal efficiency decreases drastically with reductions in oxide concentration.

Recent investigators tell us that the absorption rate is primarily controlled by the rate of the chemical reactions.^{4,8} Our work supports the theory that chemical reaction rates control.

Therefore, at the low concentrations which are of interest here, we can expect poor removal efficiencies.

To obtain effective removal by absorption and chemical reaction, it will be necessary to develop efficient methods for contacting the gas and liquid. Another possible method would be to use a catalyst to speed



CONTROLLING mechanism governs removal efficiency—(Fig. 2)

up the chemical reactions until diffusion becomes controlling; however, no effective catalysts have been reported.¹

From experiments with a wetted-wall column, Caudle and Denbigh found that the rate of nitrogen oxides removal from gases is directly proportional to the interfacial area between the gas and the liquid.² This indicates the best removal efficiency can be obtained by supplying the maximum gas-liquid contact area.

We can provide this by dispersing the gas as small bubbles in the liquid (bubble-cap tower) or by dispersing the liquid in the gas (spray tower, venturi injector). Data on absorption equipment are reported here for:

- Bubble-cap towers.
- Fritted-gas bubblers.
- Packed towers.
- Spray towers.

For adsorption, Foster and Daniels indicate that silica gel gives good removal efficiencies of nitrogen dioxide at gaseous concentrations as low as 0.1%.⁵ Mechanical factors—such as cycle changes and desorption requirements—make the process more complicated than a continuous absorption process. However, the method is capable of accomplishing essentially complete removal of nitrogen oxides from gases.

TEST RESULTS

Fig. 1 presents comparative results showing the effect of entering oxide concentration on the removal efficiency for different equipment. A reduction in oxide concentration causes a decrease in removal efficiency for

all types of equipment. Therefore, the removal problem becomes more difficult as the gases become more dilute.

Spray Towers—Results obtained with the spray tower indicate that this type of equipment is completely inadequate for oxide concentrations less than about 1%.

At higher concentrations, spray-tower efficiencies are comparable to those in other equipment, and a spray tower can be used effectively to obtain a partial removal of nitrogen oxides from concentrated gases.

Packed Towers—The removal efficiencies with the packed tower are lower than those obtained with the bubble-cap tower or the fritted bubbler. However, we should note that the decrease in efficiency with reduction in oxide content is fairly gradual. At nitrogen oxide concentrations less than about 0.2%, the packed tower would be nearly as efficient as other equipment.

Bubble-Cap Tower and Fritted Bubbler—A fritted bubbler is merely a special bubble-cap unit in which very small and well-dispersed gas bubbles are delivered into the absorbing liquid. A greater head of liquid for the gas bubbles to pass through is ordinarily used in a fritted bubbler. From Fig. 1, we can see that the fritted bubbler gives much better removal efficiencies than the other equipment tested.

Since the removal efficiency of the bubble-cap tower approaches that of the fritted bubbler at low gaseous oxide concentrations, the optimum type of absorption equipment should combine the good features of both.

Fig. 3 indicates that the gas rate and liquid head in the fritted bubbler have little effect on the removal efficiency as long as well-dispersed bubbles are formed and the liquid head is more than about 3 in.

A bubble-cap unit designed with a number of small gas outlets in the caps should approximate the beneficial effects of small bubbles and large gas-liquid contact area found in a fritted bubbler. At the same time, this design would reduce the pressure drop per stage to a practical value. The liquid head above the caps should be at least 3 in. Such a design ought to give efficiencies between the values for the fritted bubbler and the bubble-cap unit shown in Fig. 1.

Test Conditions for Removal of Nitrogen Dioxide From Gases

Equipment	Gas Rate Std. Cu. Ft./Min.	Liquid Rate Cc./Min.	Pressure Drop Cm. of Water	Notes
Fritted-glass bubbler, one stage.....	0.53	300	59.0	Medium frits. Liquid head over frits = 3.75 in.
Bubble-cap tower, one stage.....	1.06	300	1.8	Liquid depth = 1 in., slot velocity = 1.17 ft./sec.
Packed tower 0.25 in.-glass Raschig rings	0.53	150	2.0 per ft. of packed height	Superficial vapor velocity = 1.84 ft./sec., packed height = 46 in. Efficiency reported per ft. of packed height.
Spray tower, 1 No. T58-1 mm. spray nozzle	0.53	470	1.0	Superficial vapor velocity = 1.84 ft./sec., tower height = 52 in.
Silica-gel adsorber, No. 5 commercial gel (See Ref. 5)	0.53	Superficial vapor velocity = 1.84 ft./sec., packed height = 12 in., fraction saturated = 0.90. Time per cycle = 30 min. Efficiencies calc. from Ref. 5.

Silica Gel Adsorber—The silica gel adsorber gives the best removal efficiency at gaseous concentrations less than 0.4% nitrogen oxides. If you need essentially complete removal of the oxides, the silica gel adsorber should be useful. With this equipment the removal efficiency does not fall off rapidly at low gaseous concentrations.

TEMPERATURE AND PRESSURE

The shapes of the efficiency curves for absorption equipment indicate the absorption rate is primarily controlled by the rate of the chemical reactions. The reduction in efficiency with decrease in oxide content is caused by lowered fractions of oxides present as N_2O_4 in more dilute mixtures. An increase in total pressure or a decrease in temperature causes a greater fraction of the oxides to be present as N_2O_4 . This would tend to improve the removal efficiency.^{6,9}

A decrease in temperature or an increase in total pressure also increases the removal efficiency for the silica gel adsorber. Fig. 4 shows the effect of decreasing the temperature from 25 C. to 15 C., and the effect of raising the total pressure from 1 atm. to 2 atm. Note also the sharp increase in removal efficiency for the silica gel adsorber which can be obtained by decreasing the cycle time.

EXPERIMENTAL EQUIPMENT

In our bubble-cap tower we used one plate with seven bubble caps. One cap was located in the center of the plate and the other six were arranged

peripherally around this center cap. Eight equally-spaced circular slots, 0.313-in. dia., were drilled in the center cap. Four slots were drilled in each of the peripheral caps. To reduce wall effects, these slots were directed toward the center.

The packed tower we used had an inside diameter of 1 in. and was packed to a height of 46 in. with 1/4-in. glass Raschig rings. Liquid was introduced to the top of the column with flow directed onto the center of the packing. Effective wetting of the pack-

ing was obtained and we observed no channeling.

Our spray tower consisted of one No. T-58 spray nozzle, 1 mm. dia. The nozzle was directed countercurrent to a stream of gas rising through a 1-in. I. D. tower. The distance from the bottom of the tower to the nozzle was 52 in.

We also collected data using a fritted bubbler. It consisted of 12 medium-frit glass rods (fritted area = 1.03 sq. in. per rod). These rods were sealed into a Lucite plate contained in a 5.5-in. I. D. column. The equipment was arranged so that the head of liquid above the frits could be varied from zero head to as much as 15 in. of water.

EXPERIMENTAL PROCEDURE

The towers were operated under steady conditions until equilibrium was attained (as indicated by a constant acid concentration in the liquid product). Temperatures, pressures and flow rates were read. Samples of the inlet gas, inlet liquid and product liquid were taken and analyzed for concentrations.

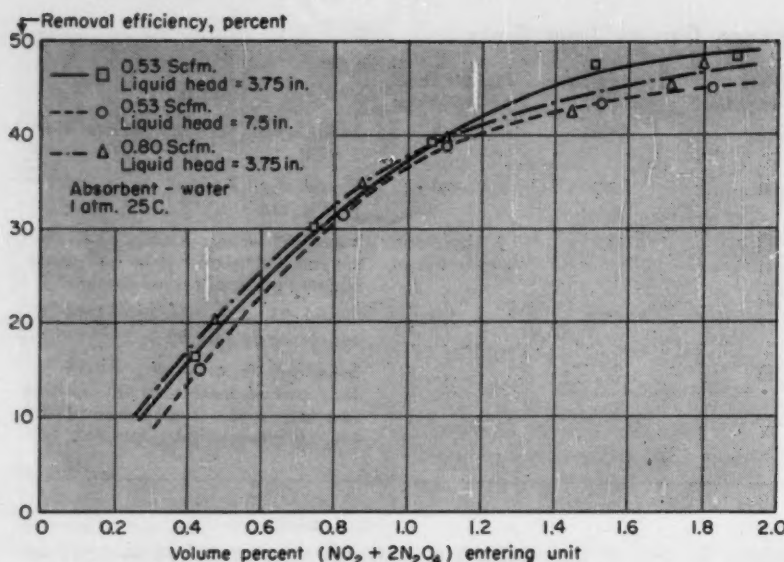
The liquid samples were analyzed by titrating a known volume with standard NaOH solution. Gas samples, taken in evacuated bulbs containing hydrogen peroxide, were weighed. The amount of nitrogen oxides present could be found by titration. Nitric acid is formed by the reaction between H_2O_2 , NO_2 and N_2O_4 .

From a knowledge of the flow rates and concentrations, we calculated removal efficiencies. These are expressed

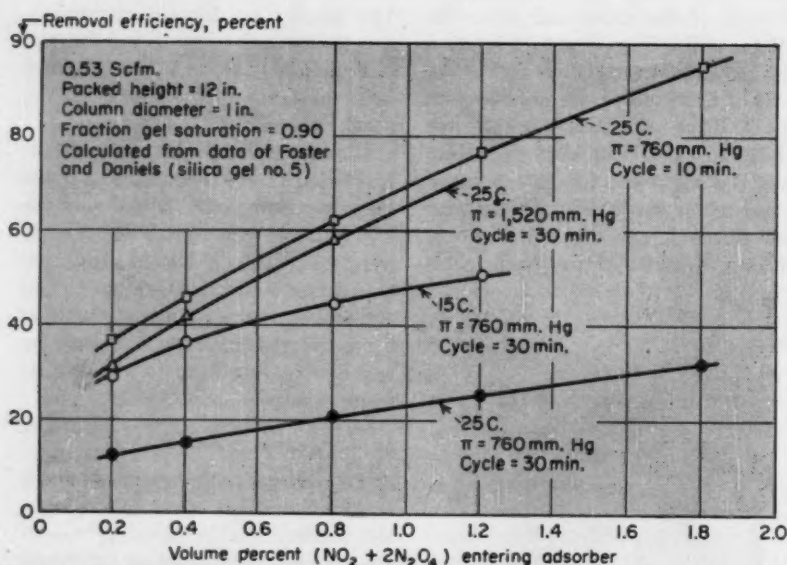


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FRITTED BUBBLER gives consistently good results—(Fig. 3)



SILICA GEL ADSORBER shows wide range of efficiencies—(Fig. 4)

as the percent of the entering oxides that is removed.

CHOICES OF VARIABLES

In comparing the removal efficiencies of the various types of equipment, it's necessary to choose the variables such as gas rate, column height and liquid rate of magnitudes that give a fair comparison.

Tests by Chambers and Sherwood³ and more recently by Hohman⁴ indicate that aqueous solutions of sodium hydroxide do not give as good removal

efficiencies as water. Consequently, water was used as the absorbent for all the runs involving absorption with chemical reaction.

We found the removal efficiency to be independent of the liquid rate in the bubble-cap tower and the fritted bubbler as long as the concentration of the liquid did not increase above 10 weight percent nitric acid. The spray tower was operated at a liquid rate which would give a finely dispersed mist, while the packed tower was operated at approximately 90

percent of the liquid flooding velocity.

The units were all operated at gas rates which would approximate conditions in industrial units.

Efficiencies for the bubble-cap, spray and fritted-bubbler units are all reported as obtained for a single contact stage. Since one stage of these units requires about a foot of height, the efficiency results for the packed tower are reported on the basis of 1 ft. of packed height.

Air was the diluent gas for all the test runs. The gas-liquid contact time in the bubble-cap and fritted-bubbler units was not sufficient for any appreciable oxidation of the NO formed in the chemical reaction. Some of the NO formed was oxidized to NO_2 in the packed and spray towers. However, this difference in the operation is necessary if we want to make a fair comparison of equipment.

All the runs were made at 1 atm. pressure and 25°C. Filtered air was used so that no visible mist was formed in any of the runs.

The efficiency results for the silica-gel adsorber are based on the data of Foster and Daniels⁵ using a superficial gas velocity of 1.84 ft./sec., packed height of 1.0 ft., gel fraction saturation of 0.90 and cycle time of 30 minutes.

We believe that the choice of operating variables as outlined above gives a fair basis for comparing the results obtained with the various equipment types. The values chosen represent—as closely as possible—those that would be used in industrial units.

ACKNOWLEDGEMENT

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How to Size Future Process Vessels

Next time you design one of the three types of vessels discussed here, check these factors. There'll make your job easier—end overdesign.

A. H. YOUNGER

SEVERAL factors underlie the design of the numerous pressure vessels of all shapes and sizes used in oil refineries and chemical plants. Handling these properly reduces the possibility of overdesigning.

Here, we discuss the sizing of several types of such vessels—vapor-liquid separators, accumulators and knock-out drums. We've omitted reaction vessels and others of a special nature.

Sizing Vapor-Liquid Separators

Vapor-liquid separators are designed to remove the vapor with a minimum amount of entrained liquid. Important design considerations include: vapor velocity, liquid surge time and reservoir capacity (for smooth level control).

Perry¹ gives a well-known formula for allowable vapor velocity:

$$u = k \sqrt{\frac{\rho_l - \rho_v}{\rho_v}}$$

Where

u = allowable velocity, ft./sec.

k = constant

ρ_l = liquid density, lb./cu. ft.

ρ_v = vapor density, lb./cu. ft.

If the vapor space is three feet or more, k is usually taken as 0.2. Table I compares the actual velocity with the calculated allowable velocity for

seven vessels now in use. In every case the actual velocity is much less than that calculated. Therefore, taking k as 0.1 instead of 0.2 should give adequately sized vessels for most cases.

Knowing the vapor velocity and the vapor flow rate allows calculation of the cross-sectional area, and from that the vessel's diameter. To find the vessel's height, consider the necessary liquid surge time. A good value for this is 3 to 5 min. Generally, separators have little variation in feed rate so a longer surge time allowance is unnecessary.

Separators are usually designed so the vapor-liquid interface is in the center of the vessel. But at the low vapor velocities which usually prevail, a vapor space of more than three feet doesn't significantly decrease entrainment. However, to take care of level variations, add another foot to the vapor space.

Hence, to calculate vessel height divide the needed surge volume by the cross-sectional area and simply add the 4-ft. vapor space—instead of the usual practice of using the surge height as half the vessel height.

If the interface level is to be automatically controlled another factor should be checked—the reservoir capacity in gallons per inch of depth. This is governed by the time it takes



A. H. Younger is now process engineer with Chemical Construction Corp., N. Y. A Canadian, he's had considerable experience in oil refinery and chemical plant design, both with W. M. Barnes & Co. in Canada, and with C. F. Braun in this country. Unable to unearth any article on sizing process vessels to help him solve a recent design problem, he collected data on a number of existing vessels and, after a critical evaluation of them, wrote this short, helpful article.

for the control valve to go from fully open to fully closed. Elfers² gives some data on the reservoir capacity needed for various flows:

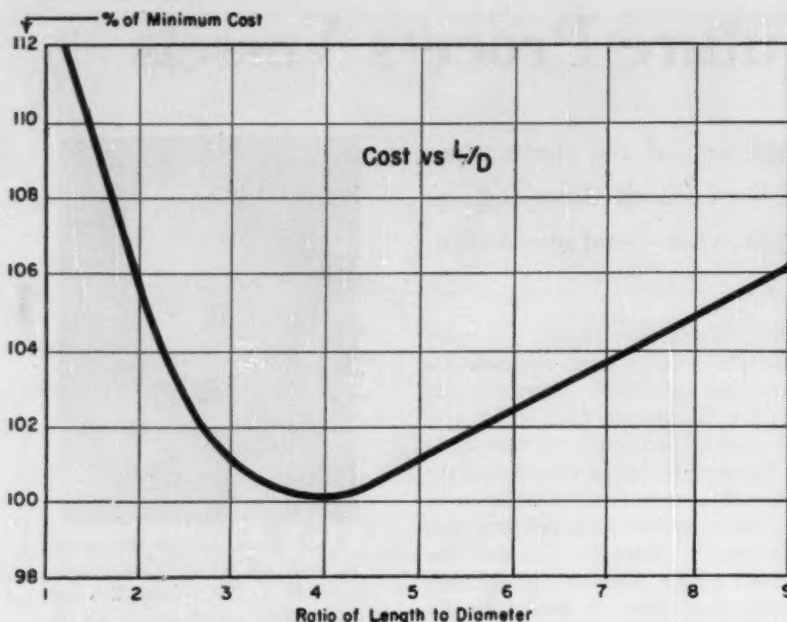
Flow, Gpm.	Reservoir Capacity Gal./In. of Depth
100	2
200	3
400	4
600	5
800	6
1,000	8
1,500	15
2,000	24

The vessels listed in Table I meet this requirement. (Continued)

Design Data From Seven Vapor-Liquid Separators Now in Use—Table I

Diam., Ft.	Height, Ft.	Position	Cross- Sectional Area, Sq.Ft.	Vapor Flow, Cu.Ft./ Sec.	Actual Vapor Velocity, Ft./Sec.	Vapor Density, Lb./ Cu.Ft.	Liquid Density, Lb./ Cu.Ft.	Calculated Allowable Velocity, Ft./Sec.	Liquid Flow, Gpm.	Vessel Volume, Gal.	Surge Time, Min.	Reservoir Capacity, Gal./In.
4	8	V	12.5	0.46	0.037	0.075	50.0	5.1	22	750	17.0	7.8
7	20	V	38.4	4.3	0.112	0.852	54.0	1.6	670	5,750	4.3	24.0
7	25	V	38.4	28.	0.73	0.298	81.0	3.3	1,700	7,200	2.1	24.0
11	25	V	94.9	59.	0.62	0.18	82.0	4.1	1,610	17,750	5.5	59.0
3	10	V	7.05	1.5	0.22	0.67	62.4	1.9	39	530	6.8	4.4
3	5	V	7.05	1.26	0.18	1.17	56.1	1.4	12	265	11.0	4.4
51½ in.	8	V	14.4	0.36	0.025	0.343	50.5	2.4	21	860	20.5	9.0

PROCESS VESSELS . . .



Design Data From 18 Accumulators Now in Use—Table II

Diam., Ft.	Height, Ft.	Position	Volume, Bbl.	Flow, Bpd.	Surge Time, Min.	L/D Ratio
3	10	H	12.6	585	15.5	3.3
2	5 1/3	V	3.0	967	2.2	2.67
8	15	V	134.0	11,500	8.4	1.88
8	20	H	179.0	17,960	7.2	2.5
12	40	H	800.0	24,150	23.8	3.3
3	6	V	7.6	1,040	5.2	2.
11	30	H	510.0	32,600	11.2	2.73
4	8	H	18.0	1,500	8.6	2.
8	24	H	214.0	16,000	9.6	3.
10	24	H	335.0	15,000	16.0	2.4
4	12	H	26.6	4,800	4.0	3.
2 1/2	10	H	8.7	1,300	4.8	4.
5	16	H	56.0	5,800	7.0	3.2
4 1/2	16	H	45.0	2,900	11.1	3.56
6	16	H	80.0	2,300	25.0	2.67
7	12	H	82.4	6,920	8.4	1.72
8	15	H	134.0	10,050	9.7	1.88
9	14	H	159.0	17,200	6.7	1.58

Design Data From 11 Knock-Out Drums Now in Use—Table III

Diam., Ft.	Height, Ft.	Position	Cross- Sectional Area, Sq. Ft.	Flow, Cu.Ft./ Sec.	Actual Vapor Velocity, Ft./Sec.	Vapor Density, Lb./ Cu.Ft.	Liquid Density, Lb./ Cu.Ft.	Calculated Allowable Velocity, Ft./Sec.
5	10	V	19.6	108.0	5.50	0.127	40.	3.5
4	10	V	12.6	5.5	0.44	0.475	42.	1.9
2	4	V	3.14	0.8	0.25	0.078	56.5	5.3
3	10	V	7.05	10.0	1.40	0.140	62.4	4.2
3	8	V	7.05	10.65	1.52	0.784	62.4	1.78
3 1/2	8	V	9.65	21.3	2.2	0.133	62.4	4.30
8	20	H	50.5	180.0	3.5	0.076	37.4	4.44
5	20	H	19.7	56.0	2.84	0.131	38.8	3.44
3 1/4	8	V	8.7	10.3	1.2	0.45	62.4	2.35
4 1/2	10	V	15.9	54.3	3.3	0.10	62.4	5.0
1 3/4	6	V	2.2	1.4	0.63	0.31	38.8	2.2

Sizing Accumulators

Condensed overhead vapors from distillation columns collect in vessels called accumulators. These keep the tower functioning smoothly and prevent tower fluctuations from affecting downstream equipment. Hence, surge time is the basic design factor in designing vessels for this type of service.

Today's practice seems to vary as to the proper surge time. Table II gives data on 18 vessels now in use. Surge time in these varies from 2.2 to 25 min. But since most fluctuations can be taken care of in 5 min., a good working range for most designs is 5 to 10 min.

This fixes the surge volume. Vessel size is calculated by taking this as half the volume of the vessel exclusive of heads.

The next problem involves the vessel dimensions—the length to diameter ratio. In the graph at the left the L/D ratio is plotted against the percent of minimum cost for horizontal steel vessels of the same volume, number of nozzles, man-holes, etc. The minimum comes at an L/D of 4 to 1. In the range from 2.5 to 6 the cost varies only 2%. Thus any convenient ratio in this range should be satisfactory.

The final problem is position. Ordinarily, horizontal vessels are preferred—placed directly below a series of horizontal condensers and supported by the same structure.

Sizing Knock-Out Drums

In sizing knock-out drums use the same equation as for separators, but use a k of 0.2. From the existing vessel data compiled in Table III, this seems to be satisfactory. The drums described do not appear to be over-designed.

With knock-out drums, surge time is not as important as with accumulators. However, an undue amount of liquid should not be allowed to collect. An L/D ratio of 2 to 1 should be adequate.

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Chemical Engineering Fundamentals

Interpretation of Kinetic Data—II

THOMAS E. CORRIGAN, Research Engineer, Olin Mathieson Chemical Corp., Brandenburg, Ky.

In last month's installment (*Chem. Eng.*, Apr. 1955, p. 199) we covered in some detail the use of initial rates in the interpretation of kinetic data. This month we shall cover the methods which use reaction rates at finite values of conversion.

Use of Rate Data at Finite Conversions

Although the initial rates may be quite helpful in the selection of a mechanism, they are not sufficient evidence in themselves to establish the mechanism or to evaluate the rate constants. The rates at finite values of conversion must be used also. There are several methods for using the data to establish the rate equation. Briefly, they are:

(1) Put the rate equation for each mechanism in the linear form:

$$f(r) = a + bp_A + cp_R + \dots$$

and solve for the rate constants.

(2) Plot $f(r)$, a function of rate, vs. p_A and observe the shape of the curve.

(3) Evaluate the constants by trial and error until an equation is obtained which fits the data.

(4) Use an integrated form of the rate equation and solve for the constants by the use of simultaneous equations.

(5) Use the equation in the integrated form:

$$W/F = af_1(x) + bf_2(x) + \dots$$

and solve for the constants directly from the experimental data using the method of least squares. In this equation the terms $f_1(x)$, $f_2(x)$ are functions of x that can be evaluated separately by either numerical or graphical integration.

Applying Finite Conversion Rate Methods

Let's consider each method in detail as it applies to the reaction of A going reversibly to R and S.

Method 1—If the rate equation were

$$r = k[p_A - (p_R p_S / K)] / (1 + K_A p_A + K_R p_R + K_S p_S) \quad (1)$$

$$r = [p_A - (p_R p_S / K)] / (a + bp_A + cp_R + dp_S)$$

it could be rearranged to the form

$$[p_A - (p_R p_S / K)] / r = a + bp_A + cp_R + dp_S \quad (2)$$

Here the unknown constants appear only in the linear terms on the right side and $[p_A - (p_R p_S / K)] / r$ is the function of rate.

We assume that K , the equilibrium constant, is also known. If not, it can be obtained from the x vs. W/F curves since x becomes asymptotic to the equilibrium value. The rate and the corresponding partial pressures can be evaluated from the x vs. W/F curves and the constants obtained by the method of least squares.

This is done for each mechanism. If any of the constants for a given mechanism is negative, that mechanism is rejected. For this method to be valid the terms p_A , p_R and p_S must be independent variables. Therefore, a series of x vs. W/F curves must be obtained in which some R or S or both are introduced into the feed. If only a feed of pure A is used, p_R and p_S are not independent variables, and c and d can not be determined separately.

This method is probably the least desirable one for integral-reactor data because of the tedious calculations involved.

Method 2—Another way of indicating the mechanism is to write the rate equation for each mechanism as:

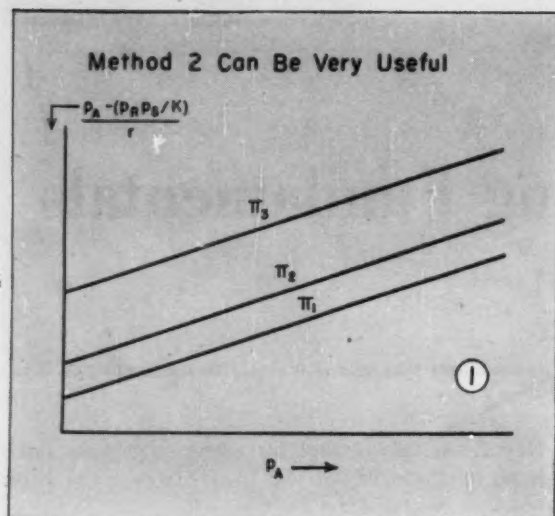
$$f(r) = a' + b'p_A \quad (3)$$

If a plot of $f(r)$ vs. p_A is not a straight line, probably the particular mechanism for which the equation was derived does not apply.

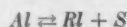
As an example, consider the mechanism for which

Nomenclature (Consistent units)

a, b, c, d	Empirical constants
a', b'	Empirical constants
A, B	Reactants
f	Function of
F	Feed rate
k	Rate constant, forward reaction
K	Equilibrium constant
p	Equilibrium partial pressure of adsorbent gas
r	Reaction rate
R, S	Products
T	Absolute temperature
W	Mass of catalyst
x	Degree of conversion
π	Total pressure



the single-site surface reaction is the controlling step:



The rate equation for this mechanism is

$$r = k[p_A - (p_R p_S / K)] / (1 + K_A p_A + K_R p_R) \quad (4)$$

This may be put into the form

$$[p_A - (p_R p_S / K)] / r = a + b p_A + c p_R \quad (5)$$

If all the data had been obtained with the use of pure A in the feed, these relations would hold:

$$\pi = p_A + p_R + p_S \quad \text{and} \quad p_R + p_S = 2p_R$$

since $p_R = p_S$. Therefore,

$$p_R = (\pi - p_A) / 2$$

Thus, Eq. (5) will reduce to

$$[p_A - (p_R p_S / K)] / r = a' + b' p_A$$

where $a' = a + \frac{1}{2}c\pi$; and $b' = b - \frac{1}{2}c$.

Plots of $[p_A - (p_R p_S / K)] / r$ vs. p_A for a series of values of total pressure will give a set of straight parallel lines. If we plot the intercepts of these lines against pressure, we get a straight line of intercept a and slope equal to $\frac{1}{2}c$. The constant b may be obtained from the slope of the original family of curves and the value of c , since $b' = b - \frac{1}{2}c$. See Fig. 1.

This method is not so widely applicable as the initial-rate method, but it is very useful for some reactions.

Method 3—Determine the constants by trial and error. The two methods above are useful for preliminary examination of the data and for establishing a fairly close value for each constant. After the less likely possibilities are eliminated, the one or two possible equations that remain may be tested against the original x vs. W/F curves by graphical integration.

$$W/F = \int_0^x dx / r \quad (6)$$

and r is calculated from the selected rate equation.

If the calculated curve does not fit the data exactly, the constants may be adjusted one at a time and the

curve replotted after each adjustment until a close fit is obtained. This method is not recommended except as a final adjustment because it is tedious.

Method 4—In some cases, especially if the rate equation is not very complicated, the equation can be integrated analytically. The constants can then be solved for directly from the experimental data or from plotted curves of smoothed data.

As an example, take the case of the reaction of A going reversible to R and S. For the case of a single-site mechanism with surface reaction controlling,

$$r = k[p_A - (p_R p_S / K)] / (1 + K_A p_A + K_R p_R)$$

This can be integrated to give

$$\frac{W}{F} = a \left[\left(\frac{1}{2b} - \frac{1}{2b^2} \right) \ln \frac{1 + bx}{1 - bx} + \frac{x}{b^2} \right] + c \left[\frac{1}{2b^2} \ln \frac{1 + bx}{1 - bx} - \frac{1}{2b^2} \ln (1 - b^2 x^2) - \frac{x}{b^2} \right]$$

where $a = (1/k\pi) + (K_A/k)$; $b = (2/k\pi) + (K_R/k)$; and $c = [1 + (\pi/K)]^{0.5}$. (See reference 3.)

However, in most cases it is more convenient to use graphical integration after the equation constants have been determined.

Method 5—Graphically integrate tables of integrated functions. After you assume a mechanism and derive the rate equation it is then necessary to establish the constants of this rate equation. The method of "f" tables rather than the old and more familiar method of slopes can be used. We'll outline the derivation for calculating the constants by this method.

The Method of "f" Tables

Suppose we are given this rate equation:

$$r = k[p_A p_B - (p_R p_S / K)] / (1 + K_A p_A + K_R p_R) \quad (7)$$

and the general expression for finding W/F :

$$W/F = \int_0^x dx / r \quad (8)$$

We can then obtain an expression for W/F by substituting Eq. (7) in Eq. (8).

$$\frac{W}{F} = \int_0^x \frac{(1 + K_A p_A + K_R p_R) dx}{k[p_A p_B - (p_R p_S / K)]}$$

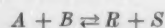
By setting $1/k = a$, $K_A/k = b$, $K_R/k = c$ and inverting the denominator, we obtain a set of three integrals:

$$\frac{W}{F} = a \int_0^x \frac{dx}{p_A p_B - (p_R p_S / K)} + b \int_0^x \frac{p_A dx}{p_A p_B - (p_R p_S / K)} + c \int_0^x \frac{p_R dx}{p_A p_B - (p_R p_S / K)}$$

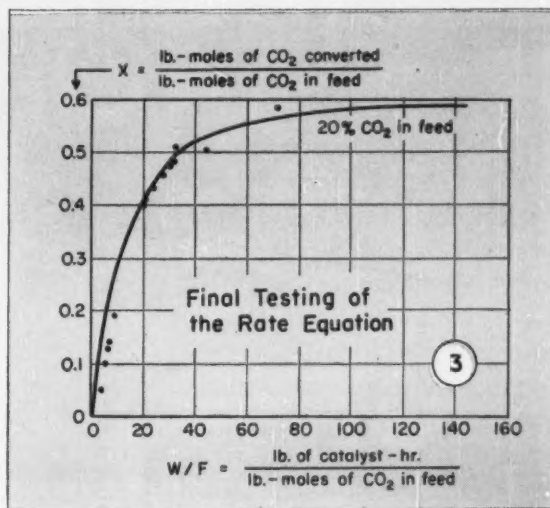
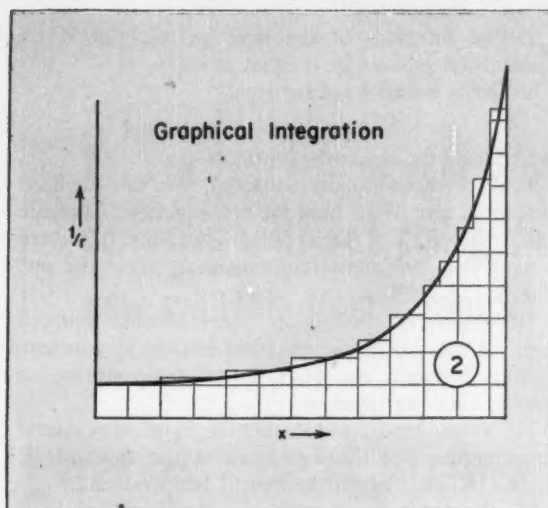
This may be abbreviated to read

$$W/F = af_1 + bf_2 + cf_3$$

If the inlet composition and total pressure are known from the stoichiometry of the reaction, the values of the partial pressures can be expressed in terms of conversion. For the reaction,



using an inlet composition of 50% A, 50% B and a total pressure of 1 atm., the above equation becomes:



$$\frac{W}{F} = 4a \int_0^x \frac{dx}{(1-x)^2 - (x^2/K)} + 2b \int_0^x \frac{(1-x) dx}{(1-x)^2 - (x^2/K)} + 2c \int_0^x \frac{x dx}{(1-x)^2 - (x^2/K)}$$

where x is in moles of A converted per mole of A in the feed. Similar expressions can be found for any feed ratio and total pressure.

The values of these integrals are found by plotting the various functions against conversion and taking the area under the curve from zero to the experimental values of conversion. With W/F and the values of the integrals known at the various experimental points, we can then find the values of the constants.

To find the values of these constants some mathematical method must be used. One is the method of least squares, operating upon the method of "F" tables. This states that in establishing an equation for a line from experimental points, the sum of the squares of the deviation of the experimental points from the calculated line shall be a minimum.

Since the terms in the integral can be calculated for corresponding values of x , the integrals can be evaluated graphically and tabulated or plotted against x . We can then use the experimental conversion and W/F values directly to solve for the constants. The necessity of taking tangents is eliminated.

The danger of an undue influence from the shape of the French curve used in making the graphs is also removed.

The method of "F" tables is not applicable to all mechanism equations but it is quite useful for those in which the adsorption terms are to the first power.

Final Testing of the Equation

Once we decide upon the correct rate equation and evaluate the constants, we must check the equation against the experimental data. To do this:

- Calculate r for a series of values of x .

- Calculate W/F for a series of values of x .
- Plot $1/r$ against x .

Take the areas under the curve for successive values of x , since

$$W/F = \int_0^x dx/r$$

A plot of x vs. W/F is then compared with the original data. The rate equation should be checked not only with the experimental data that was used in obtaining the equation but also with the data which have not been used previously in the correlation. (See Figs. 2 and 3.)

Since the constants are temperature dependent, they must be evaluated at several temperatures. They can usually be correlated by a plot of their logarithms against reciprocal temperatures. (See Fig. 4.)

In some cases it may be possible to measure the equilibrium adsorption constants by an independent study. These should agree reasonably well with those evaluated from the rate equations by the methods described above. If they do not, the constants in the rate equation should be considered empirical.

Interpreting Differential-Reactor Data

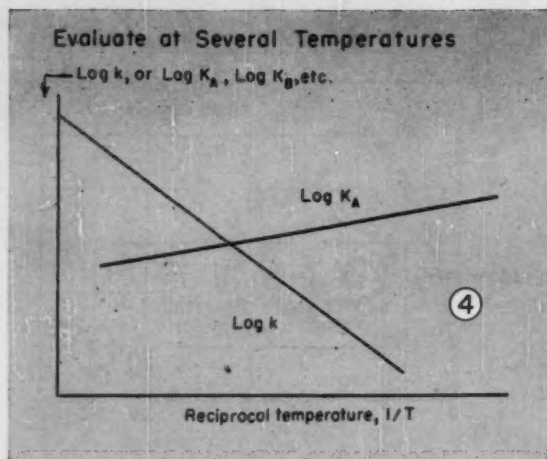
Differential-reactor data are much easier to interpret than are integral-reactor data for three reasons:

- The interpretation is not sensitive to the shape of a curve.
- The partial pressures of the products may be made independent variables more easily because the amount of products fed in each run may be varied.
- The initial rates are measured directly.

The first two of the five methods described above are directly applicable to differential-reactor data. In fact, they apply better to differential data than to integral-conversion data because r_0 and r values are obtained directly from the data for each run.

The final rate equation from differential-reactor data

CE REFRESHER . . .



can be checked directly since the original data are already in the form of rate and partial pressure for each constituent. The equation, to be valid, should check with data that were not used previously in the determination of the constants.

Mechanism for Simultaneous Reactions

We have covered methods for determining the rate equation and its corresponding mechanism for the case where only one over-all chemical reaction is involved. The case in which several chemical reactions are taking place simultaneously is much more difficult to analyze. There is no instance in the literature where a complete kinetic analysis has been made of such a case.

However, Cochrane developed a method which when applied to simultaneous reactions can eliminate many of the possible mechanisms that do not apply. Applying this method to the important commercial reaction of natural gas reforming, he was able to eliminate all but six out of over 100 possible mechanisms. We refer you to his original work (Ref. 2) for details.

A Summary of How to Interpret Data

Here is a summary of the steps to use in obtaining and interpreting kinetic data:

1. Either an integral or a differential reactor can be used to obtain the data, but the reactor must be isothermal.
2. Make a check to be sure that diffusion is a controlling factor in the rate of reaction.
3. If you use an integral reactor, plot the data as conversion, x , vs. the time factor, W/F . All the points on a single curve must be at isothermal conditions.
4. List all the possible mechanisms and derive the corresponding rate equations. (For a list of possible mechanisms see Ref. 1.)
5. Determine the initial rates from the experimental data by using any of the methods listed previously.
6. Plot the initial rate, r , or an initial rate function (such as π/r_s) vs. pressure or reactant ratio as the case may be. This will eliminate some possible mechanisms.

7. Plot functions of the type $[p_A - (p_A p_B/K)]/\tau$ against total pressure or reactant ratio.

8. Derive equations of the type

$$[p_A - (p_A p_B/K)]/\tau = a + b p_A + c p_B$$

and evaluate the remaining constants.

9. With the constants evaluated, you can calculate the plot of x vs. W/F from the rate equation. Compare this calculated plot with the original data. If there is more than one possibility remaining, select the one that fits the data best.

10. Repeat the procedure at several other temperatures. If more than one equation remains at one temperature but only one holds for all temperatures, we usually select the latter.

11. When you have evaluated the equation at several temperatures, plot the logarithms of the constants k , K_A , K_B , K , etc., against reciprocal temperature.

12. Determine an equation of the form $\log k = (a/T) + b$ for each constant.

Once a rate equation is determined and the constants are evaluated as a function of temperature, the equation can then be used for the design of all types of reactors.

The reactors designed from this equation do not have to be isothermal—unlike the experimental reactors—but can be adiabatic or nonisothermal nonadiabatic. The equations can also be used to calculate reactors with back mixing effects and with recycle.

With the fundamental rate equation the chemical engineer can calculate the amount of catalyst and product distribution for practically any combination of operating conditions that he wants to test. With this equation he can study the effect of varying the ratio of reactants, of recycling of products, of heating, of cooling or of adiabatic operation. By calculation he may study the effect of each operating variable separately and in this way learn the best possible operating conditions.

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2. Cochrane, T. J., Master of Science Thesis, Chemical Engineering Department, West Virginia Univ. (1951).
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NEXT MONTH

We'll discuss the effect of fluidized beds on the rate equations and work out some sample problems in the interpretation of kinetic data.









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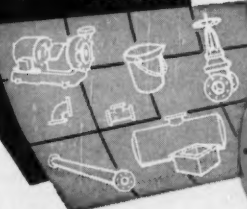
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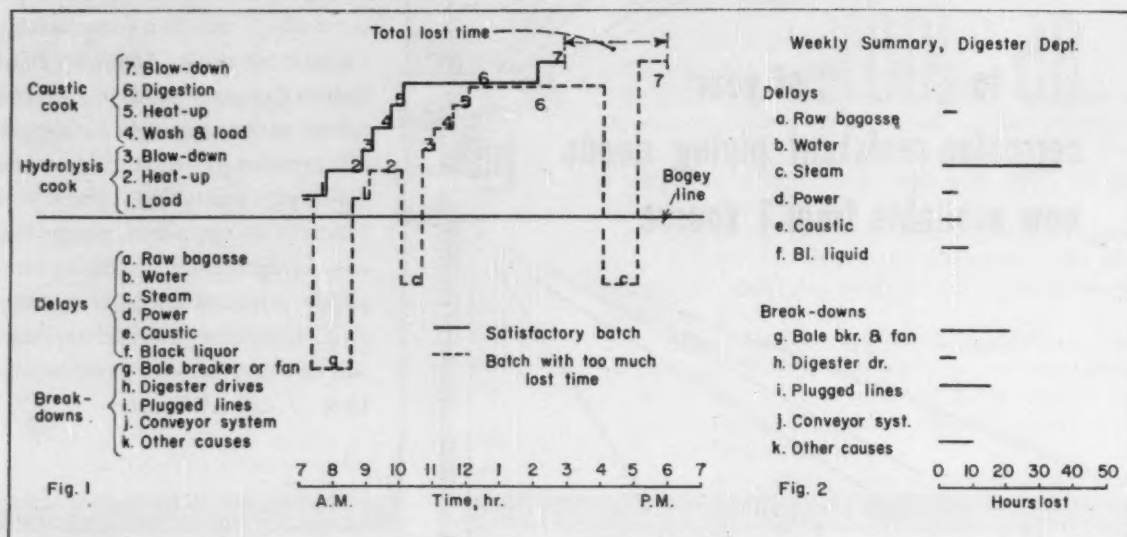
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★ February Contest Prize Winner

Spot Bottlenecks in Your Batch Process

A. R. Valdez

Engineering Dept., Brown & Root, Inc., Houston, Tex.

The charts that appear above present a simple and effective method of detecting and accurately pinning down the bottlenecks in any batch process. The method has already been used with a great deal of success. Although the charts given refer to the digesting department of a bagasse pulp paper plant, this system of plotting is applicable to any batch process.

Fig. 1 is the day-by-day operating chart. It can be made as large as desired and posted prominently in

each department. On it the department foreman can easily fill in the history of each batch, and three or four batches can be described on the same chart for compactness and ready comparison.

The chart is simply a time plot of the various operating steps, above a heavy horizontal line which can be called the "bogey" line, or "profit-and-loss" line. Below the bogey line are plotted any of a variety of delays that take place. The chart is prepared by listing the

various process steps above the line, and below it the principal causes of delay which might tend to make the digesting department a bottleneck. The time of each process step is then plotted on the same line as the name of the step, for example heat-up on line 2. Similarly, if there are delays, for example, due to a steam shortage, the delay is plotted below the bogey line on line c.

The solid-line time plot on Fig. 1 gives an example of a batch which conformed closely to the established operating procedures. No delays occurred so that none of the time lines appear below the bogey line.

The dotted line portrays an example of a batch which was con-

★ March Contest Prize Winner

"Quick and Certain Test Finds Leaking Tubes in Heat Exchange Equipment."

A prize of \$50 in cash will be awarded to Frank G. Radis, plant superintendent, Montrose Chemical Co., Newark, N. J. Mr. Radis' method will be described in the Plant Notebook for June.

\$50 PRIZE FOR A GOOD IDEA—Until further notice the Editors of *Chemical Engineering* will award \$50

cash each month to the author of the best short article received that month and accepted for publication in the Plant Notebook. Each month's winner will be announced the second following month and published the third following month.

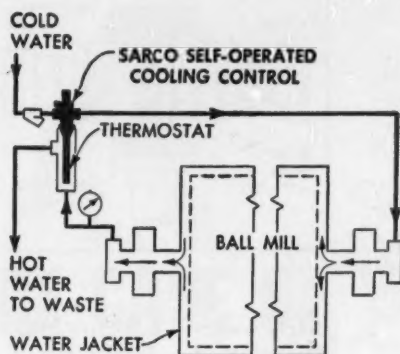
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Articles may deal with plant or production "kinks," or novel means of presenting useful data, which will interest chemical engineers. Address Plant Notebook Editor, *Chemical Engineering*, 330 West 42nd St., New York 36, N. Y.

How to get more out of process steam



Sarco Cooling Control hook-up on ball mills at Berry Bros. Inc.

Why it Pays to Control Water Jacket Temperature

Sometimes a process calls for cooling rather than heating. Take this typical case history.

Berry Brothers Inc., paint manufacturer in Detroit, uses ball mills to grind pigments. Using manual control, operators were unable to hold jacket water at required temperatures. Since jacket temperature affects grinding time, a costly bottleneck was created in the mill department. Grinding time varied from batch to batch.

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Results: Cooling water is now maintained at required temperatures. Operations are faster and on a time-table basis. Installation was so successful, Sarco Cooling Controls are now installed on 19 ball mills. Meter tests made by the plant superintendent show monthly savings of \$40 to \$45 in reduced water consumption.

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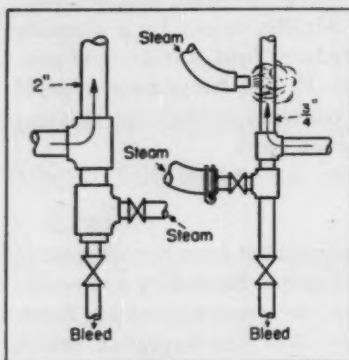
PLANT NOTEBOOK . . .

siderably delayed because of a burn-out of the loading fan motor and because of an insufficient supply of steam. Note that the regular processing steps appear above the bogey line in this case also, and that the overall process required about three hr. too much because of the delays.

Fig. 2 is a composite report of delays for the digesting department which can be drawn up once a week, or once a month, by adding together the individual batch delays as shown by time lines below the bogey line on Fig. 1. The composite chart, if it has any excessively long lines, clearly shows which de-

lay sources should be investigated in an effort to reduce the troubles from lost time.

This system is easy to set up and easy to keep in operation. It enables one to follow the history of each batch through the plant, and makes it possible to detect with accuracy any deficiencies in equipment, process or personnel which will show up as recurring delays. Every time line below the bogey line represents lost time, reduced plant capacity, and thus higher unit production costs. But the chart makes it leave its own record, and so points the way to correction of the process difficulties.



How to Clear a Congealed Stock Line

Chesman A. Lee

Engineer, Darling & Co., Chicago.

Recently I had a $\frac{3}{4}$ -in. pipe line, 50 ft. high, freeze up with congealed grease. Usually it is a slow job to melt out such a line with a steam hose, as one must keep going back over the part previously melted out.

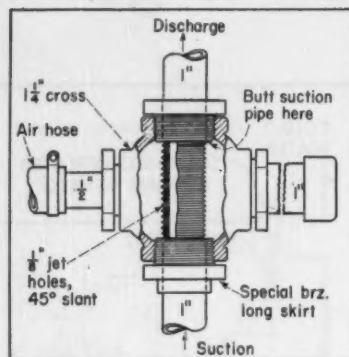
Such a line will usually have a steam connection for blowing clean at the end of each use, but this will not help if the line should freeze, since there is no place for the condensate to go.

The problem with the $\frac{3}{4}$ -in. line reminded me of a somewhat similar problem some years ago when a 2-in. two-story-high vertical line congealed with a high-melting wax. We added a steam and bleeder con-

nection as shown in the left-hand pipe sketch. We then turned on the steam and bled out the melted wax and condensate, proceeding rapidly in the vertical section, and somewhat more slowly in the horizontal section. The latter was aided by alternately turning on the steam and blowing out the melted stock. Without this system we had previously had to take down similar lines for melting out, which required a good deal of time whenever necessary.

With the $\frac{3}{4}$ -in. line a slight modification was necessary. There was a tee and bleeder connection at the foot of the line. It was easy to add another tee and steam hose connection, as in the right-hand sketch, rather than a permanent steam connection, since the trouble was not expected to recur. However, we found that the $\frac{3}{4}$ -in. diameter did not have sufficient area at the face of the stock to give adequate melting speed. We therefore used a second steam hose to heat the outside of the pipe. The combination was very effective and only one pass was needed, with the stock melting out almost as fast as the hose could be moved up the pipe.

Since such lines tend to freeze when not properly blown out—and sometimes when some valve is not closed tight—it pays to have an easy way to clear them. The methods shown will do it.



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Paul C. Ziemke

Safety Engineer, Oak Ridge, Tenn.

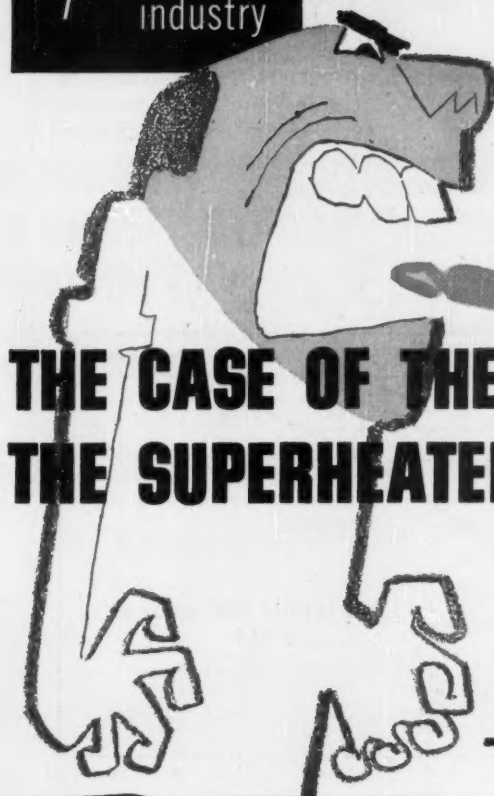
Transferring chemicals and other liquids, such as lubricating oils, from drums to other vessels or to permanent storage can be a back-breaking chore if proper equipment is not at hand. Sketched above is a simple ejector made from pipe and fittings which can easily be assembled in any shop and will save the price of a pump.

There are many ways of unloading drums, some hazardous because the drum itself is put under pressure. With this gadget, only the ejector is under air-line pressure. So, if the liquid in the drum is sluggish, the only effect will be to move it more slowly. And if the liquid is particularly viscous, then a drum warmer can be used.

Also, there are many ways to build ejectors from pipe fittings. I've tried several of these and find the design illustrated to be one of the best, especially for drum unloading. Simply take a $1\frac{1}{2}$ -in. cross and bush down three of the branches to 1 in., the fourth side to $\frac{1}{2}$ in. The bottom bushing is preferably special, made on the shop lathe with an extra long skirt to help support the suction pipe. All other fittings are standard.

At the left is a length of $\frac{1}{2}$ -in. pipe to which the air hose is clamped. The bottom suction pipe should be about 30 in. long, the upper end provided with a running thread so that it can screw through the cross and butt against the top

SK apades in
industry



Once upon a time there was a Production Superintendent who radiated Btu's like a boiler gone berserk. He got that way because of balky pumps.

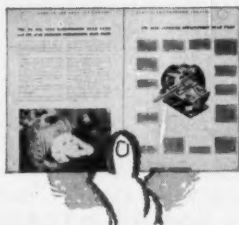
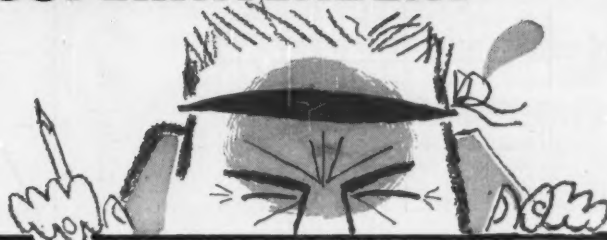
"It's a viscous circle," he snarled at his Assistant. "Every time we try to pump asphalt or hot road oil, these infernal pumps conk out. Lines get tied up. Tanks can't be cleaned. Barges and trucks can't be loaded. Process units shut down . . ."

"A truly deplorable state of affairs," sympathized the Assistant, "but not uncommon in refineries and petrochemical plants . . ."

"Do something about it!" roared the Production Super. "Find me some dependable pumps to handle viscous materials, or I'll make you a night watchman!"

"I never liked night work," said the Assistant. "So—here goes." He bolted into his office and dived into his data files.

THE CASE OF THE PAMPERED PUMPS AND THE SUPERHEATED SUPERINTENDENT



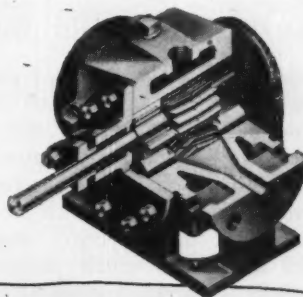
What he wanted was there! A copy of Schutte and Koerting Bulletin 17-A on Gear Pumps. Types, operating ranges, design features—just the information he needed. "Steam jacketed gear pumps," said the Assistant. "Could be. I'll have a talk with an SK Sales Engineer."



He did—and the SK pump expert was more than helpful. He asked some searching questions about materials to be handled, gave the Assistant a careful analysis of his problem—and came up with a specific recommendation.

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MORAL:

Send for your copy of Bulletin 17-A on Gear Pumps. And when you're ready for more details, call in a specialist—your nearest SK Sales Engineer.



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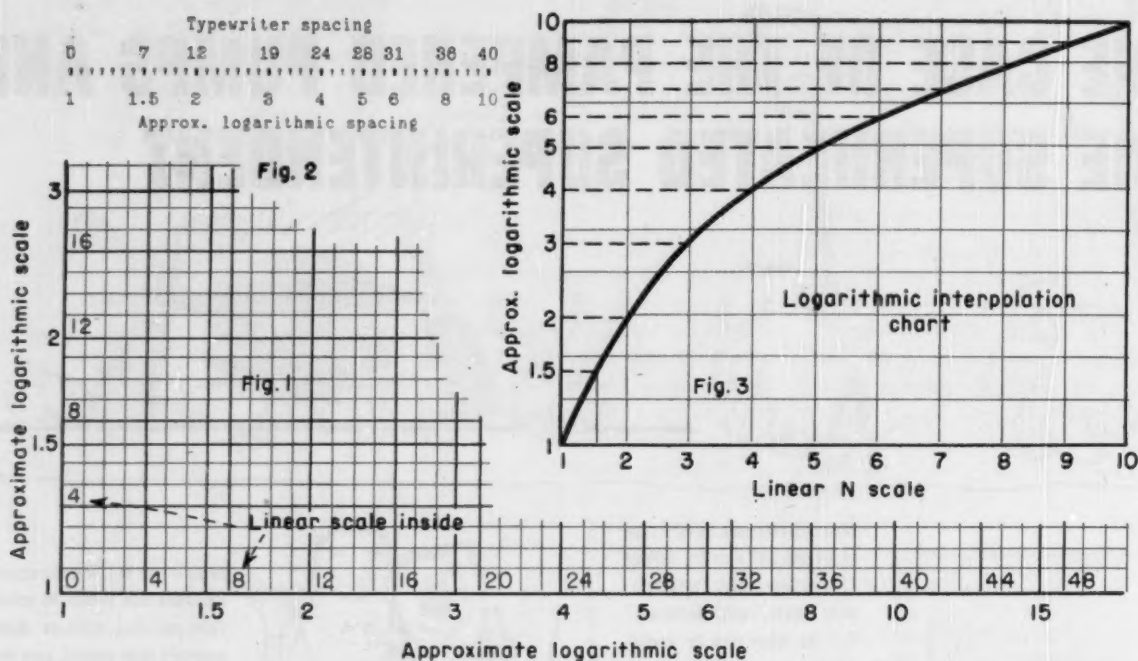
PLANT NOTEBOOK . . .

discharge pipe. To provide the air-jet action for lifting, the upper couple of inches of the suction pipe is drilled with a single line of $\frac{1}{8}$ -in. holes, slanting up at 45° , and assembled with the holes toward the air inlet. A short length of pipe capped and screwed into the right-hand side of the cross makes a con-

venient handle of whatever length desired.

To use the ejector it is simply dropped into the bung of the drum and the air hose coupled to any convenient outlet on the plant compressed air system. The 1-in. discharge line can be coupled to a piece of hose of any suitable length

for delivery to whatever tank is to receive the liquid. For minute control a pressure reducing valve may be desirable at the plant air line, but usually this is not necessary, adequate control and a steady liquid stream from the discharge hose being attained with a simple throttle valve on the air supply.



Logarithmic Scales From Linear Spacing

Paul J. Grogan

Chairman, Department of Engineering, University Extension Division,
The University of Wisconsin, Madison, Wis.

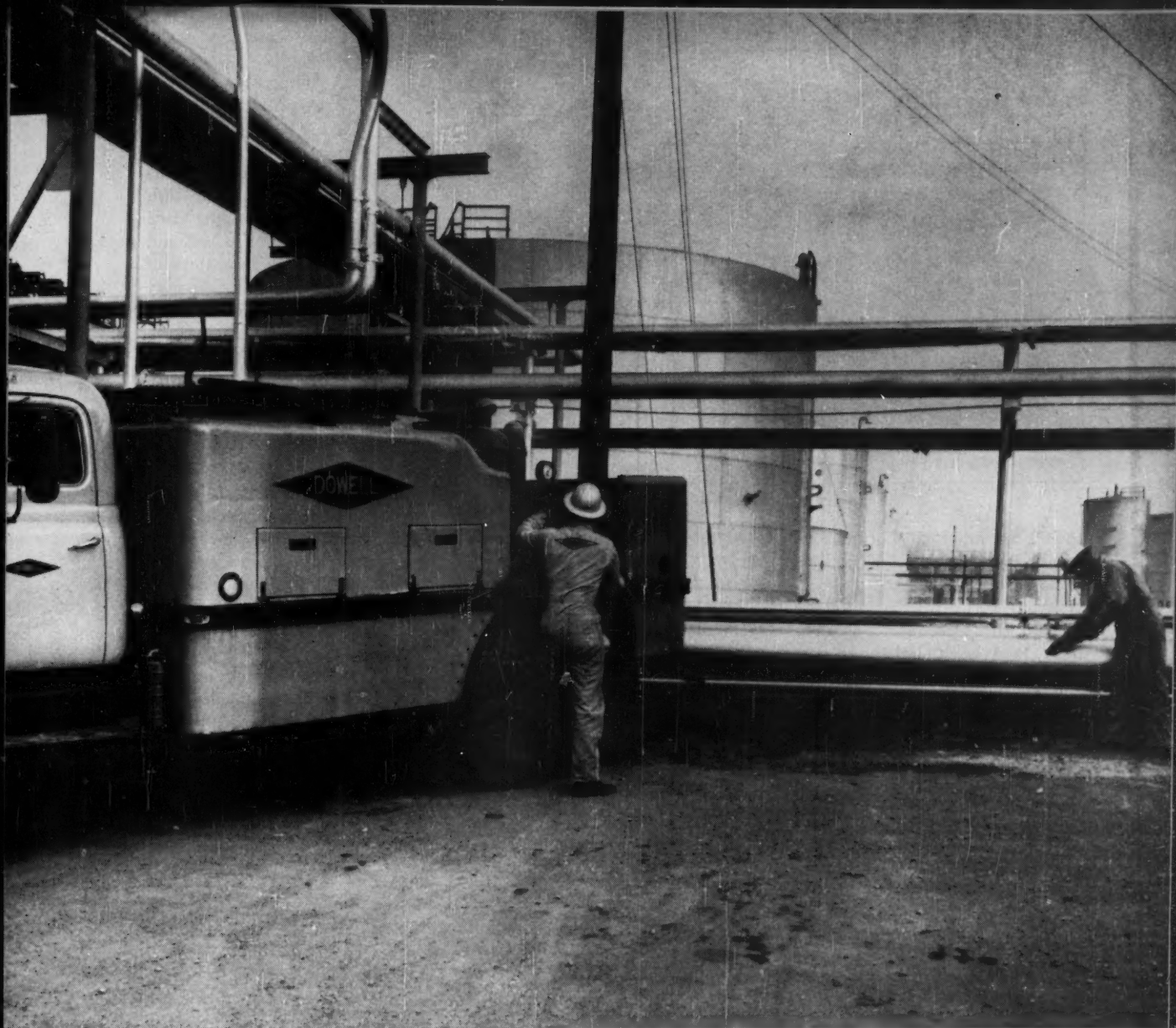
The advantages of representing many physical variables along logarithmic scales are well known. Often the range of a variable is such that it is impossible to use linear space representation without sacrificing clarity in the range of small values. Other variables increase or decrease exponentially, particularly with respect to time, and are most logically presented on a semi-log plot. Lastly, the mathematical relationship between two variables may be unknown. A log-log plot will often reveal how the variables are related.

There are a variety of semi-log and log-log graph papers available commercially. Yet the range of problems encountered in day-to-day work often calls for arrangements of cycles which are not in immediate supply or otherwise available. This article proposes a relatively simple solution to this dilemma.

If one lays a 10-in. log scale (for example, the D-scale of a 10-in. slide rule) on a piece of $\frac{1}{4}$ -in. linear cross section paper he will find that several important marks on the scale will coincide quite closely with ruled lines on the paper. This

comes largely from the fact that \log_{10} of 2 is so close to 0.3. This means that the logs of 4 and of 8 will correspond closely to 0.6 and 0.9 respectively. So, along side the $\frac{1}{4}$ -in. paper, the log of 2 will fall at about 3 in. or 12 divisions from the left end, the log of 4 at about 6 in. or 24 divisions, and the log of 8 at 9 in. or 36 divisions from the left. Log of 10 is 10 in. or 40 divisions and it will be found that other important marks of the log scale fall close to certain lines of the paper (or at intervals of 40ths of the 10-in. scale).

The close correspondence of these important marks with 40ths of a linear scale of the same length will be apparent from the table presented here. Although the table is worked out for numbers from 1



CHEMICAL CLEANING SAVED COSTLY LINE REPLACEMENT

After mechanical methods failed, DOWELL solvents removed thick scale from piping, restoring million-gallon capacity

During an oil refinery's annual turn-around, three weeks were spent attempting to clean a 20-inch water disposal line by mechanical methods. Each attempt failed to remove the scale, which ranged from 6 to 14 inches in thickness. Then—only seven days before the plant was scheduled to resume operations—Dowell was called. Dowell engineers used chemical solvents to restore the line's original capacity of 1,300,000 gallons of water per day. This job, which avoided a costly line replacement, took just six days.

Most Dowell jobs are completed within a few hours. Many lines have been cleaned without being taken out of operation

at all. More time and expense are saved, too, because Dowell solvents are introduced through regular connections, avoiding costly dismantling and digging up of buried lines.

Then, too, Dowell solvents are designed to clean the *entire line*—bends, elbows, valves and any other hard-to-reach sections. Whenever the scale encountered makes it necessary, Dowell supplements chemical cleaning with pipe line pigs and jet moles.

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Common Fraction Approximations of Certain Logarithms

N	Common Logarithm	Approximate Logarithms		% Accuracy
		Decimal Value	Equivalent Fraction	
1	0.00000	0.0	0/0	100.00
1.5	0.17609	0.175	7/40	99.38
2	0.30103	0.3	12/40	99.66
3	0.47712	0.475	19/40	99.56
4	0.60206	0.6	24/40	99.66
5	0.69897	0.7	28/40	99.66
6	0.77815	0.775	31/40	99.60
8	0.90309	0.9	36/40	99.66
10	1.00000	1.0	40/40	100.00
15	1.17609	1.175	47/40	99.91
20	1.30103	1.3	52/40	99.92
30	1.47712	1.475	59/40	99.86
40	1.60206	1.6	64/40	99.87
50	1.69897	1.7	68/40	99.94
60	1.77815	1.775	71/40	99.82
80	1.90309	1.9	76/40	99.84
100	2.00000	2.0	80/40	100.00

to 100, any other range of numbers can be represented equally well by these approximate logarithms. Successive powers of 10 simply fall 40, 80, 120, etc., spaces apart. Furthermore, there is no need to use 4-in. coordinate paper, since any spacing will do, simply counting spaces as the table shows. Thus, it is easy to make up a log scale to any modulus length, provided only that the length can be divided into 40ths.

One advantage of this system is that the matching points closely represent the most important lines of a log plot as needed for slides, charts and magazine articles. The points 1, 1.5, 2, 3, 4, 5, 6, 8, 10,

15, 20, etc., are all included, as the log-log scales of Fig. 1 show. This makes it easy to use the approximate logarithms for preliminary data plotting in the field, or for deciding on the choice of cycles for the final drawing.

Although mentioned for preliminary use, the approximate logs may be accurate enough for final plotting. The poorest one has an accuracy of 99.56% and in many the inaccuracy is of the order of 1 part in 300, or better than many engineering data. Furthermore, the heavy lines marking the principal coordinates on graph paper will normally overlay such an error. Still

better accuracy can be had if only a single logarithmic cycle is to be represented, by letting the 12th linear space represent the true logarithm of 2, with the 24th and 36th spaces the true logarithms of 4 and 8. Then the average accuracy is 99.90% and the maximum error, at 10, is 0.34%.

One interesting way to make such log scales, when they are to appear in typewritten or various kinds of duplicated copy, is on the typewriter. The two common typewriter types are "pica," with 10 characters per inch, and "elite," with 12 characters per inch. As in Fig. 2, the typewriter can be used as a marking and counting machine to divide a 4-in. scale into 40 divisions on a pica typewriter, or a 3.33-in. scale into 40 divisions on an elite typewriter.

Since scales produced in these ways are not closely divided, care is necessary in plotting data. One of the scales of a slide rule, perhaps laid on the graph at an angle, often serves to locate points to two or three significant figures. Another way is to make a logarithmic interpolation chart as in Fig. 3, plotting a curve of N vs. $\log N$. For this purpose the approximate logs may be used.

How to Prepare Surfaces for Painting

Bryan Greenwood

Paint Foreman, McMillan & Bloedel Ltd., Nanaimo, B. C., Canada

Much money is spent each year by the paint manufacturers in developing paint coatings suitable for all branches of industry and capable of withstanding the various corrosive conditions—sea water, corrosive fumes, acids, alkalis, salts and weather.

The manufacturers are doing a good job and the engineers can select coatings to give long service under almost all industrial conditions.

Many consumers spend considerable money testing various coatings. Both manufacturer and consumer try to get the most suitable material for the job, but much of this effort

is wasted if the surface to be painted is not properly prepared prior to coating.

The optimum surface condition for metal requires that it be chemically clean, slightly etched, dry, warm, with a slightly acid condition and a pH of 3 to 5.

To get this ideal condition is often economically out of bounds and physically very difficult to achieve.

However, the cost engineer must keep this optimum condition in mind when deciding how much surface preparation will be repaid by extended paint life.

Various methods of surface preparations are in use, among them:

1. Blast cleaning—sand or shot
2. Flame cleaning
3. Chemical cleaning
4. Mechanical means e.g., power wire brush, chipping hammers and vibrating hammers
5. Hand cleaning
6. Weathering

Sand-blast cleaning is a quick and sure method of removing mill scale, rust, old paint and any foreign matter. It also etches the surface which, when rust proofed, gives an ideal surface for priming. Objectionable features of sand-blasting are the dust and flying sand. This hazard can be reduced by hanging heavy curtains around the working area.

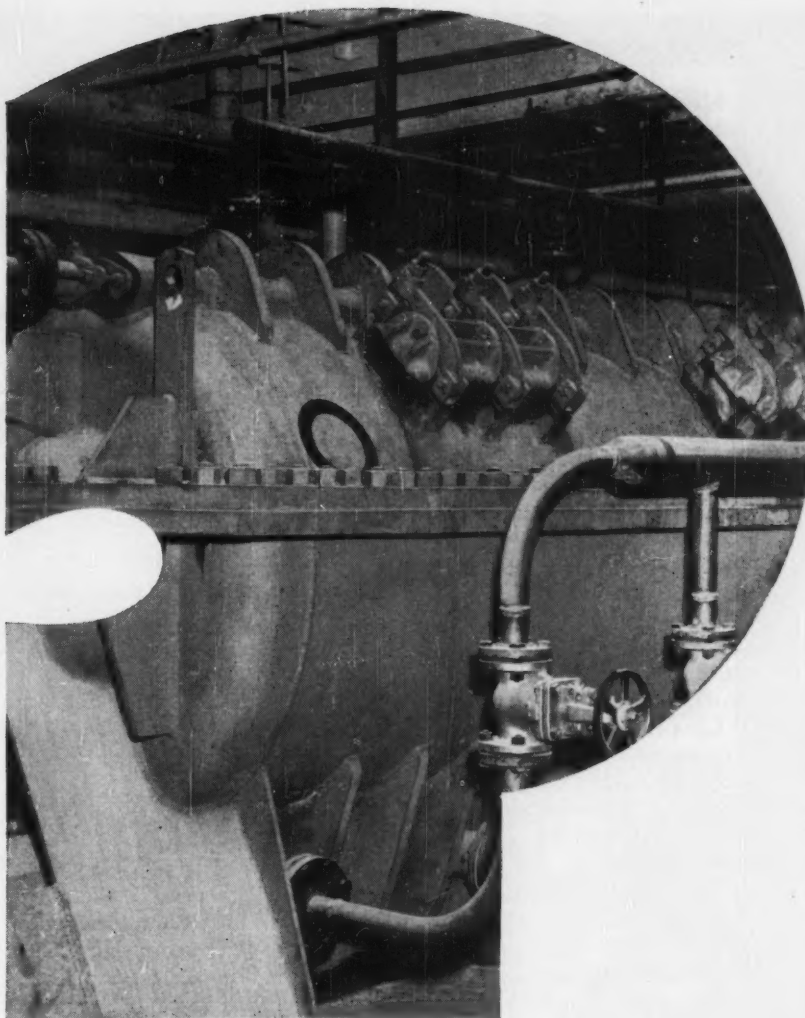


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PLANT NOTEBOOK . . .

Flame cleaning removes scale, unbounded paint, and any combustible material. It is immediately followed by power wire brushing and primed while the metal is dry and warm. The expanded metal allows the primer to penetrate into open pores. However, rust proofing is not practical with flame cleaning.

Chemical cleaning of parts that can be immersed in the chemical and rinse tanks is very effective. Larger articles are cleaned with chemical solution and a steam gun or by coating with paste mixtures and a final water rinse. Rust-proofing is sometimes combined in the cleaner or can be applied after the water rinse.

Mechanical and hand methods consist of wire brushing, chipping, vibrating, air-jet blow-off, and solvent washing.

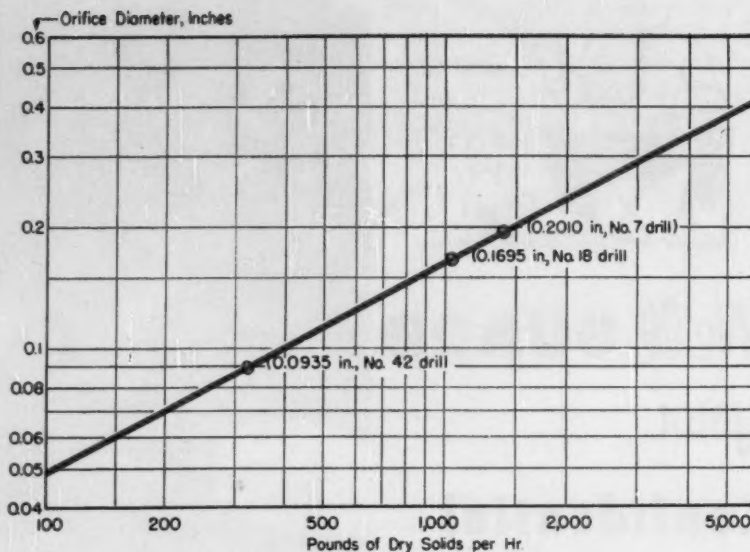
Light rust and loose matter can be removed by wire brushing. Chipping and vibrating are required for heavy scale. Oils and soluble matter require washing off with a solvent.

Weathering will in time loosen mill scale, but unequal exposure causes loss of metal at some points before loosening of scale at others. The loosened scale and rust can be removed by wire brushing.

Rustproofing with a phosphoric acid solution converts a microscopically thin layer of metal into a minute crystalline film of insoluble metallic phosphates which resist rusting and prevent rust-creep under the paint film. Rustproofing with a wash primer (phosphoric acid, zinc chromate, in a vinyl butyral solution) also reacts on the metal surface to give a thin, tough, insoluble coating. Both methods leave the surface in excellent condition for priming.

The three basic steps for satisfactory paint life are:

1. Surface preparation, as discussed here, to get as close to optimum conditions as economically possible.
2. Selection and application of the primer coat.
3. Selection of finish coats compatible with the primer and as resistant as possible to conditions of service.



Pilot Plant Metering of Heavy Slurries

Lionel J. Fourrier

Development Engineer, Texas Div., The Dow Chemical Co., Freeport, Tex.

During the course of a pilot plant investigation it became necessary to meter a heavy, viscous slurry. The slurry was a normal process stream being pumped by positive displacement pumps at a pressure of 150 psig. and at a rate of 6,000 lb. per hr. of suspended solids. For the pilot plant investigation flow rates of from 100 to 500 lb. per hr. of suspended solids were needed.

We first attempted to tie into the process stream and throttle the flow by means of globe valves. Valves from $\frac{3}{4}$ down to $\frac{1}{4}$ in. were tried, but with little success. Each of these valves would "choke off" in all but the full-open position. This indicated that the space between the disk and the valve seat was so small, and the viscosity so high, that the valves plugged in spite of the relatively high line pressure available.

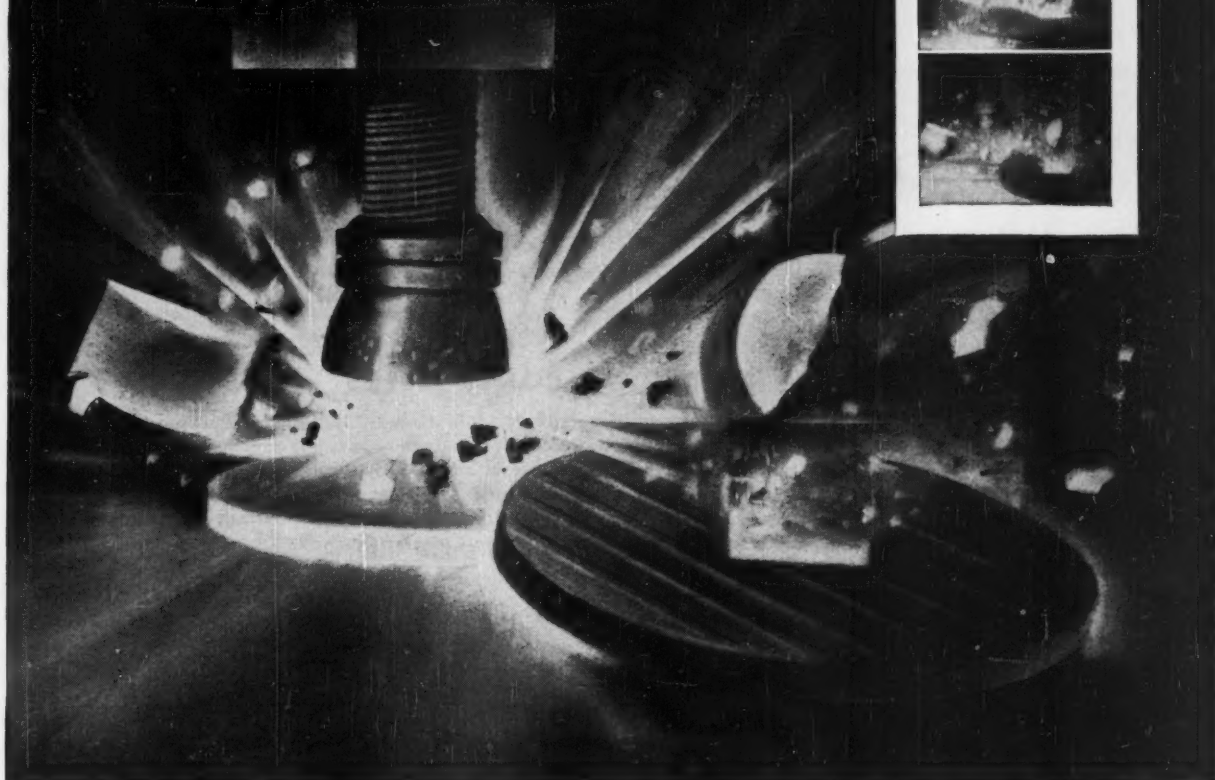
We therefore decided to try using orifices because the resistance to flow would be essentially at a point and confined to a circular area, rather than distributed around an annulus possessing some depth. The orifices we finally used were made of standard pipe fittings—

common pipe caps with a hole drilled in the end. Several orifices were made by drilling a different size hole in each cap.

The orifices were then calibrated by timing the flow of a definite volume (5 gal.) of slurry at full line pressure, then measuring the specific gravity and percent solids of the slurry. With these data the flow rates in pounds of solids per hr. were calculated. A plot of the flow rates in pounds of dry solids per hr., vs. orifice diameter in inches, gave a straight line on log-log paper. Thus it became a simple matter to determine any orifice size for a given flow rate from the calibration curve. Flow rates can be changed by simply replacing the orifice cap with one of a different diameter.

A given calibration curve will apply as long as the line pressure and solids content remain the same. If the pressure or solids concentration, or both, are changed, then the whole series of orifices can be recalibrated by making another calibration run with two difference orifices and plotting the results on log-log paper.

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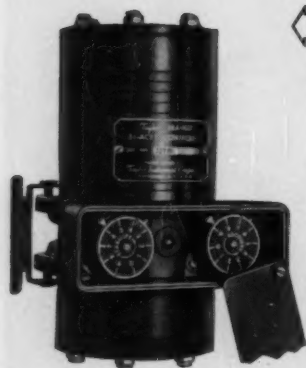
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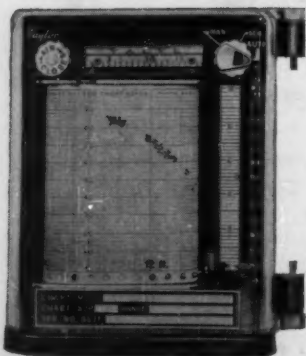
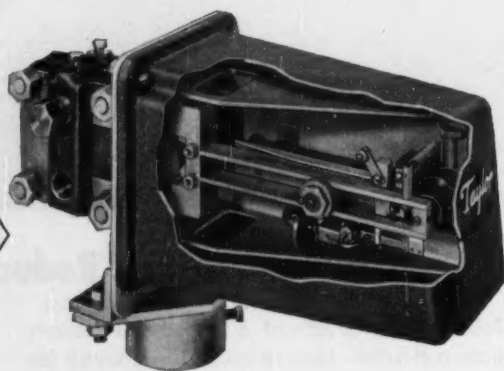
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What's your company's role and aim?

Gain Now the Executive Skills You'll Need

An alarming number of engineers flop when made managers. Here's how you can avoid their errors and do a successful job.

No question about it. Engineers are climbing into management ranks in greater numbers than ever. Technology is setting the pace in industry. And as it does, the engineer's training and his analytical approach to problem-solving have grown more valuable for decision-making posts.

And he's taken over those posts. It wasn't too long ago that you found the engineer in the plant or at the drafting board, and that was that. If you came across one in the board room or an executive's office,

he was probably there to report to the financial men and the lawyers who managed the company.

Engineers who worked their way to top company posts, then, were rare. Not so today. One authority reports that 40% of all industrial executives have had engineering training. Another says that top management in well over one half of our 150 largest corporations is engineer-trained. And a recent Manufacturing Chemists Association survey reveals that over 50% of the chemical industry's top ex-

ecutives are technically trained—over 15% are chemical engineers.

Finally, the government's Bureau of Labor Statistics claims that some 30% of all chemical engineers are now in management posts.

The Opportunities Exist—But

Now more than ever, the opportunities are there for the chemical engineer to climb into a top level post. Yet, based on past experience, a high percentage of those who try will fail—largely through their own fault.

Why do engineers fail when they move into management? How can their errors be avoided? These are vital questions for any engineer with ambitions for an eventual management position.

Many studies of this problem



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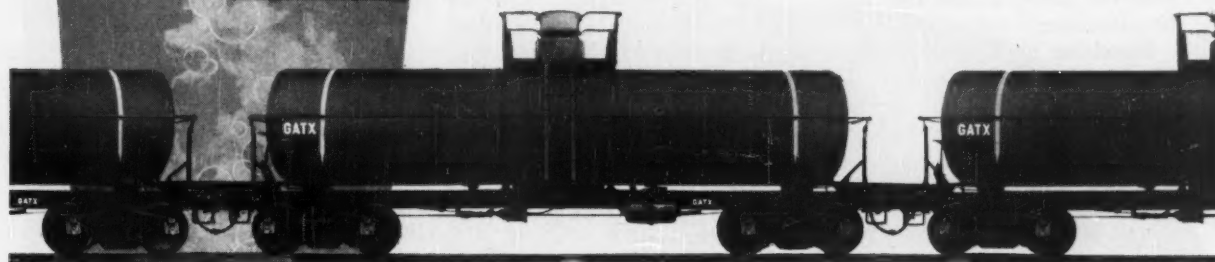
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have been made. Most analyses group the main stumbling blocks into the human relations category.

In general, engineers have many pluses when considered for management. They know process fundamentals; they understand the use and limitations of various production methods and types of equipment; they have a good sense of organization and of handling details. Above all, they've been trained in orderly thinking, and instinctively seek to decide issues on facts not emotion.

Why They Flop

But these same qualities can also work against them. With their characteristic reverence for fact, many engineers tend to undervalue opinions and the many unmeasurable intangibles—attitudes, emotions, traditions, prejudices, etc., which may mean much to others.

Getting specific, engineers who fail in management usually do so in four areas: Neglecting those things which don't seem logical to them no matter how important they may be to others; delegating authority; grooming successors; making decisions too slowly, though they may be painstakingly correct.

Stumbling blocks in these areas can trip the unwary engineer. To route your course through them to a higher post, you have to know more about them.

Neglecting the Nonlogical

The engineer with ambitions in management must realize that he has to deal with people, as well as facts. And people act in inexact, nonlogical, and often illogical ways.

The engineers' analytical approach can solve a host of problems, but it's not invincible in management. When you're dealing with people on a day-by-day basis, an appreciation of the nonlogical ranks high. And getting along with and dealing with people is the prime job of a manager.

Unfortunately, too many engineers seem to feel that anything that can be measured and assigned a value is more important than that which can't. This tendency shows up in those engineers who prove

unsuccessful managers. They recognize the nonmeasurables—attitudes, emotions, prejudices, etc.—but they fail to deal with them.

How do successful engineer-managers overcome this? First, they recognize the importance of the way other people tick. Secondly, they keep this in mind when they communicate to others.

Communication Is Vital

Communication is the forte of the top-notch executive. This skill is important at all levels of administration.

Prime requisite for effective communication is knowledge of the other fellow. You must know the other fellow and know how he feels in order to understand what he means by his words and acts and to express what you mean in a way that he'll understand.

This is where those attitudes, beliefs, etc. become important. To be right is not enough in dealing with people and getting them to act. You also have to cater to their personality needs. You have to motivate them, and that requires that you know them.

Skill in communication is not easy to acquire. It takes constant practice in learning how individuals think, respecting them and their ideas, looking at things from their angle, creating an atmosphere in which viewpoints can be freely exchanged and bringing people into your thoughts. At higher levels of administration this skill is far more important than the engineer's technical skill.

Delegate and Groom

Engineers have also been scored for a seeming inability to delegate responsibility and authority. In striving to build a reputation for making correct decisions, engineers have a hard time "letting go" of a decision. This tendency in experienced engineers causes younger men and assistants to lean on them for ideas and for the "last word" on an idea, and slows the younger man's development.

As one authority* writes: "Dele-

gation of authority and risk taking seems to be better understood by nonengineers. It is difficult for almost all bosses to let the man of less experience and ability make decisions; it looks like a silly risk. But the problem seems to be easier for, say, sales and financial executives to overcome than for engineers."

It is important not to get so wrapped up in the current job and its demands that men are not brought along to handle future undertakings. Grooming is done by helping people develop themselves, not by making them listen to the ideas and decisions of others. Granting subordinates the authority to try things their way—and to make their own mistakes—is a mark of good management.

Engineers who can do this exist, but far too many look on such delegating as too great a risk, and prefer to rely on their own abilities and ideas. Though such men may be good engineers, they prove poor executives.

Delegating, like swimming, is an act that you learn to do only by trying it. It's an important skill of effective executives.

Timing Another Essential

One of the main areas in which engineers in management flop involves the timing of decisions. Observers complain that in trying to be "right" all the time they delay decisions until they've analyzed and explored a problem from all possible angles. For engineers this, perhaps, is as it should be. For executives, labored decision-reaching sessions can be fatal.

A prompt answer, even though it may later prove wrong, is often of infinitely more value than one which is painstakingly correct but late.

Naturally enough, engineers take a professional pride in their work and want to preserve the integrity of their decisions. But in management some compromise between the time available and the thoroughness of the thinking out process must be reached on every decision.

It's difficult to base an arbitrary ruling, to risk a reputation,

*William B. Given, Jr., *Harvard Business Review*, Jan.-Feb. 1955.

Do you have a **TOUGH** CORROSION-RESISTANT CASTING **PROBLEM?**

that needs a solution for your product design?

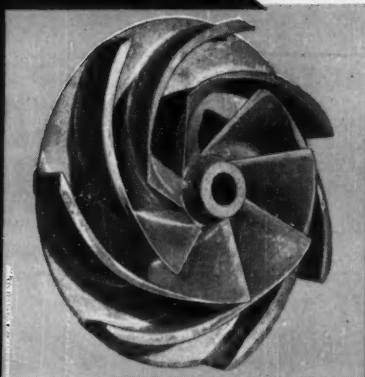
Problem—Do you require quality corrosion-resistant castings that: are also resistant to high fluctuating temperatures; machine freely; require a highly polished surface; are true to pattern; stand high pressures and high loads; are stabilized; are of large size, small size, intricate shapes; have high resistance to galling or seizing; are non-magnetic?

Solution—Consult with Waukesha—specialists in quality corrosion-resistant castings to meet the design requirements of the leading products in many industries.

Why Waukesha—Experience: Waukesha has over forty years' broad experience in providing quality-controlled, corrosion-resistant castings to industry. This hard-earned know-how and specialized craftsmanship is at your disposal.

Research: A modern laboratory guarantees castings metallurgically engineered to your specifications... **created metals** to fit the job... precise **custom castings** to help improve your products. **Facilities:** Waukesha can supply your production casting needs on schedule.

We Suggest—that you write, today, for a casting quotation from your blueprints or engineering counsel on your casting design. Informative literature available on request.
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YOU AND YOUR JOB . . .

on cloudy facts or an incomplete analysis, but recognize that it often has to be done—and be ready to do it. Having to substitute hunches for facts at times may pull your batting average down, but sometimes it's the only way to stay in the ball game.

See Things As They Are

One executive skill grows in importance the higher you climb. This is the ability to see the company as it is in relation to its internal parts and their interaction, and how the entire company fits into economic and community life.

What this gets down to is an acute awareness of what's going on. It involves gathering current knowledge about the company and its operations by reading and personal contacts, gaining an appreciation of industry happenings through trade magazines and meetings and learning about the political and social environment in which the company

exists and how this affects its operations.

Engineers have a certain conceptual skill, but this differs from that needed by executives. In considering and integrating all of the factors of company life, engineers tend to channel their thinking into narrow areas. They usually become strictly production-minded or research-minded and neglect the sales, financial and industrial relations aspects. This immediately inhibits their effectiveness as executives.

The remedy is to realize that as an executive your personal fortunes are allied with those of the company, and develop interests in all phases of the company's operations. Become as well-informed as possible on these and on industry and business affairs.

How Important Are They?

Important as your technical skill is to you now, it will become less

vital as you ascend in management. And these other skills will grow in importance. There are, in fact, numerous examples of nontechnical administrators, skilled in human relations and with an accurate conception of the organization and its role, running highly technical organizations with great success.

These men operate by using the skills mentioned here. They generally delegate a great deal of authority to subordinates, employ their abilities to handle people to coordinate the work of these subordinates and use their conceptual skill to steer the entire organization. If you can acquire such abilities in addition to your present technical know-how, you'll have valuable assets for an executive post.

Company development programs will help you. Proper coaching by senior men may be an even bigger help. But the biggest part of the development job is on your shoulders.

CHEMICAL PROGRESS

. . . And Yours

The man in the street is remarkably uninformed about chemical engineers, what they are and what they do,* and even about the chemical industry and its works in general. But gradually both the profession and the industry are getting their story across to the public.

Another chance to drive this story home is coming in a few weeks. May 16-21 inclusive has been tabbed Chemical Progress Week by the Manufacturing Chemists' Association. General purpose of CPW is to tell the American people what chemistry means to them in terms of their daily life.

Like last year's CPW, 1955 will see industry spokesmen appear before civic groups, on radio and television, in the schools and women's groups to underline the chemical industry's impact on them and their

better living standards. CPW ads, posters, pamphlets and newspaper stories will also spell out chemistry's role in the American economy. Special exhibits will be prepared and displayed, essay contests conducted and a steady stream of visitors will troop through chemical plants to see the industry and its men at work.

►What It Means—Why all the fuss? One reason was put forth by MCA in its report on the success of last year's week. Said MCA: "One of the principle barriers confronting the chemical industry in its effort to establish its significance in the minds of the American people is the lack of a specific identity such as that enjoyed by the automotive or steel industries. This concerted national effort provides a common denominator for all chemical companies whether they produce aspirin or zinc dust."

More importantly, this effort adds to public understanding of the industry and helps assure a continuing favorable climate in

which to work. For the chemical engineer its significance also lies in an increasing public awareness of the contributions of chemistry. This builds his personal prestige in the community and contributes to a better understanding of his work and greater appreciation of its worth.

SENIORITY

. . . As a Promotion Base

Engineers and their professional societies have long scored the use of seniority as the sole criterion for promotion—feeling instead that ability and merit alone should count. But a paper delivered before the National Academy of Arbitrators recently casts some doubt on this contention.

James J. Healy, associate professor at the Harvard Graduate School of Business, laid before assembled arbitrators of industry's management-labor disputes the results of his study of 46 arbitration

* For evidence, see *Chemical Engineering*, Sept. 1954, p. 244.

M·S·A

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M·S·A GASFOE RESPIRATOR

Workers exposed to nuisance concentrations of organic vapors and acid gases vote this respirator tops in comfort and vision. It's very light in weight. Many report that they hardly know they are wearing it. Users like its good looks, too. The same slick lines that give this eye-appeal also keep distracting corners out of the line of vision. Workers concentrate more because they don't have that "closed-in" feeling. All parts are independently replaceable for economy. Write for details.



M·S·A DUSTFOE #55 RESPIRATOR

Here's welcome relief from the unbalanced, bulky feeling of old-fashioned respirators. Workers know the difference the instant they put the Dustfoe #55 into place. And because it's so light, so compact, and so easy to breathe through, users report increased voluntary respirator use among workers. And comfort's only part of the story. Effective filtering action, approved by the U. S. Bureau of Mines, keeps workers on the safe side of breathing hazards. Write for details.

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● **SAFETY CLOTHING**—Safety Belts, Asbestos, Chrome Leather, Flame-Proof Duck, Plastic and Rubber Gloves, Aprons, Sleeves and Suits—Dynel Work Clothes.

● **HEAD PROTECTION**—Skullgard Hats and Caps, Glass-Fiber Hats, Combination Skullgard-Welding Shield.

● **VENTILATION EQUIPMENT**—Air Mover, Portable

Blower, Ultra-Aire-Space Filter, Welding Fume Exhauster.

● **ARTIFICIAL RESPIRATION & OXYGEN THERAPY EQUIPMENT**—Pneolator, H-H Inhalator, Pneophore, Demand Pneophore.

● **INSTRUMENTS, DUST**—Cascade Impactor, Electrostatic Sampler, Midget Impinger, Dust Counting Microprojector.

● **INSTRUMENTS, GAS**—Carbon Monoxide and Combustible Gas Indicators & Alarms, Explosimeter, Infra-Red Liquid and Gas Analyzer, Oxygen Indicator; Hydrocyanic, Hydrogen Sulphide, Carbon

Monoxide, Sulphur Dioxide and Aromatic Hydrocarbon Detectors.

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● **OXYGEN BREATHING APPARATUS**—Chemox Oxygen Breathing Apparatus, Demand Mask, Work Mask.

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YOU AND YOUR JOB . . .

awards in which a union-backed senior employee won promotion in place of a management-selected junior employee.

Three years after the awards, each company submitted a work history of the promoted employee plus an objective statement of his ability in the higher post. In 29 of the 46 cases the senior employee proved himself on the new job within a short time. And 16 of the 29 had already advanced to still higher-rated jobs.

► **Three Out of Four**—In only 10 of the 46 instances did experience prove the arbitrator's award unsound. In the seven remaining cases, management could make no judgment because the promoted employee had left the job. Thus, in three-fourths (29 out of 39) of the cases on which an opinion could be given, management admitted the seniority-based promotion worked out well—despite its own initial objections.

Significant, too, was the statement in 22 cases that supervisors doubted "whether the junior employee originally favored would have done any better on the job."

While Healy's study of 46 cases certainly doesn't rank as conclusive evidence, it does suggest that there's a good correlation between ability and length of service. Whether that correlation holds for professional and management men as well as workers also remains in doubt. But the arbitrators rated the Harvard paper as the most interesting and important of all presented at their meeting.

ENGINEERING EDUCATION

. . . Time for a Change?

Radical changes in the engineer's education are at hand if educators adopt the recommendations made in a recent study of engineering education.

Need for drastic revision of current curricula forms the basis of the final report of the American Society for Engineering Education's special Committee on Evaluation of Engineering Education. The report,

adopted by the ASEE at its recent 62nd annual meeting, is the outcome of a searching two-year study sponsored and financed by the Engineering Foundation and the Engineers' Council for Professional Development.

► **Now Deficient**—Recent extraordinary advances in science and technology and the necessity of applying these advances to future practice underscore the need for a new approach to engineering education if we are to turn out well-rounded graduates capable of becoming leaders as well as good engineers. This is the consensus of the ASEE Committee.

Specifically, the committee believes, engineering curricula must give more attention to the basic sciences, to the engineering sciences, and to humanistic-social studies.

► **Need Researchers**—Present-day engineering curricula fall down in training engineers for research, a field in which they are increasingly needed, the report emphasizes. Before 1940, the percentage of engineers in research work was small, as physicists carried on most of the fundamental research in the engineering sciences. Since then, however, research physicists have aimed their interests toward nuclear problems to such an extent that research in vibration, fluid-flow, plasticity, elasticity, electronics, engineering dynamics, and allied fields is now up to the engineer.

"The leaders of the profession twenty-five years hence," in the opinion of the committee, "must be engineers who are at no loss in interpreting, using, or contributing to the extension of engineering sci-

ence." Typical present-day curricula, however, were not designed with such an objective in mind.

► **Lengthen and Divide**—The average four-year undergraduate program is so inadequate, the committee concluded, that an engineer cannot be trained in such a course to make effective use of modern engineering-science knowledge.

As a first step, the committee recommends that curricula be broadly divided with two objectives in mind: (1) to supply engineers for production, construction, operation, selling, installing, and maintaining equipment, and the like and (2) to supply engineers and engineering scientists capable of interpreting for design purposes the data provided by research in the engineering sciences and of doing effective research.

These two broad types of curricula have been designated "professional general" and "professional scientific." Both include a thorough grounding in mathematics and courses in the principal engineering sciences. However, the "scientific" curricula goes deeper into physics and chemistry, especially atomic physics and physical chemistry than the "general." In addition, engineering analysis and design will be required for two or more years in the "scientific" curricula.

In the "general" courses, on the other hand, one year of engineering analysis and design will be considered adequate. "General" courses would place greater emphasis on humanistic-social studies. Length of the curricula would be left to the judgment of the institution involved and of the accreditation committee of ECPD.

Reaction

Two months ago in *You & Your Job* we brought to your attention George S. Odiome's plea to broaden the engineer's education. This urging, which first appeared in *Harper's* January 1955 issue, has brought forth a number of lively letters commenting on his views.

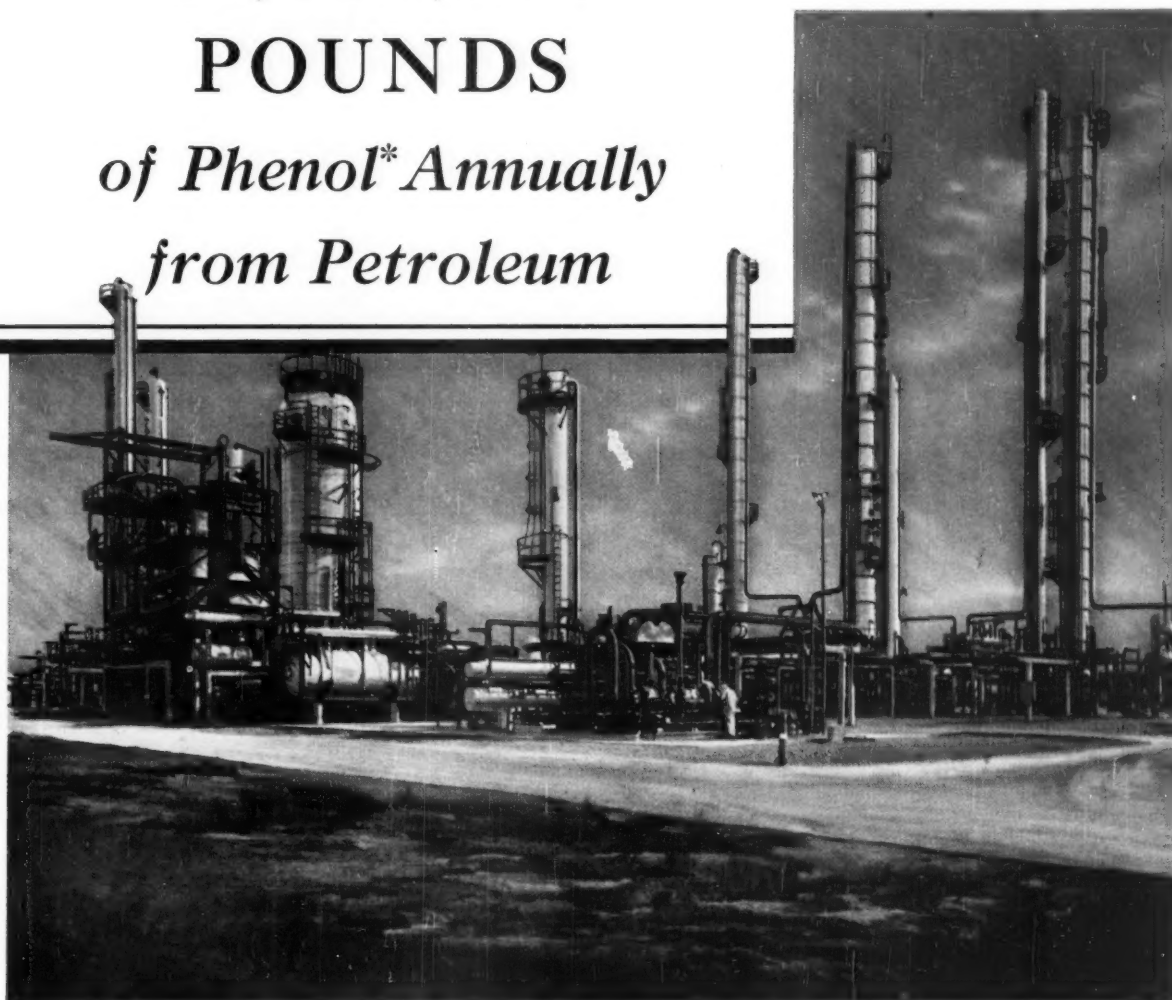
From Manistee, Mich., William H. Farnsworth writes about the formula for broadening which Odiome calls "most promising." Farnsworth feels that this system "dilutes" the engineer's training "with 3 parts diluent to 2 parts of formal engineering education."

Typical of Odiome's support is a comment from a New York chemical engineer: "I know I could do a better engineering job had I such training."

Do you feel that your training has prepared you properly for your job?

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*"Phenol" is one of today's "Big Three" in chemicals—a base material for the expanding plastics industry.



Standard Oil Company of California now is making pure phenol and acetone from cumene by a new process at its Richmond, California Refinery under license from Hercules Powder Company.

Acting as Process Consultants and Constructors, Stone & Webster Engineering Corporation worked closely with the engineers of Standard Oil, who prepared the process and mechanical designs. The plant was completed ahead of schedule and operated in excess of rated capacity.

*Write or call us for information
as to how our experience may be
of assistance to you.*



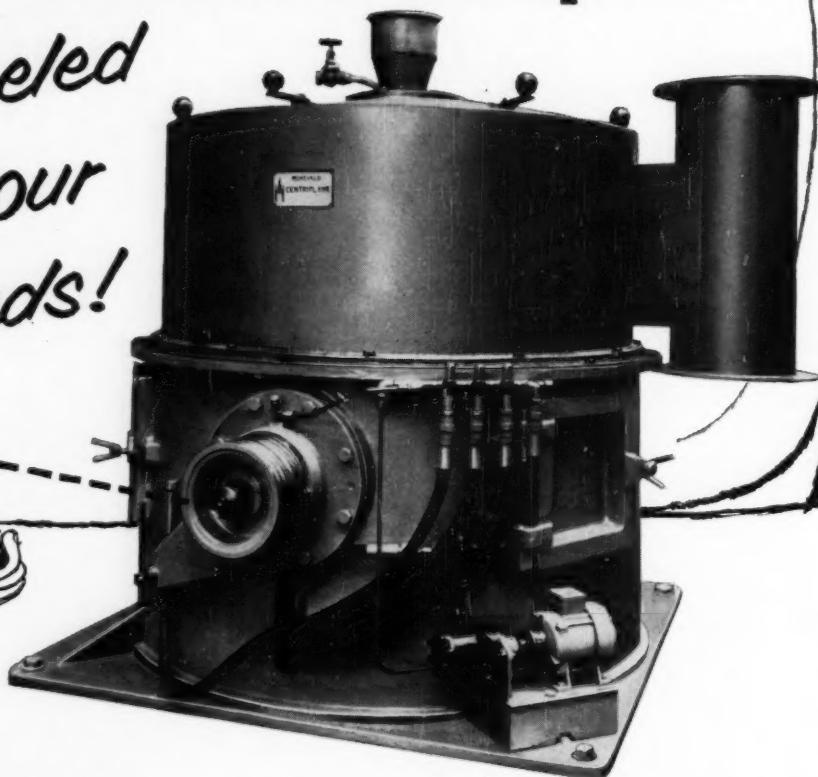
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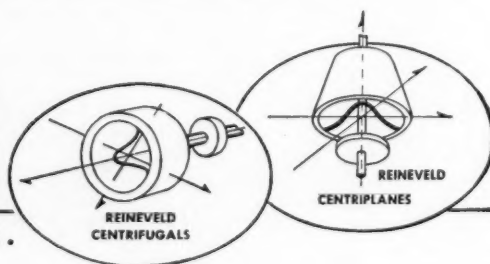
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Complete information will be available soon.

Heyl & Patterson INC.

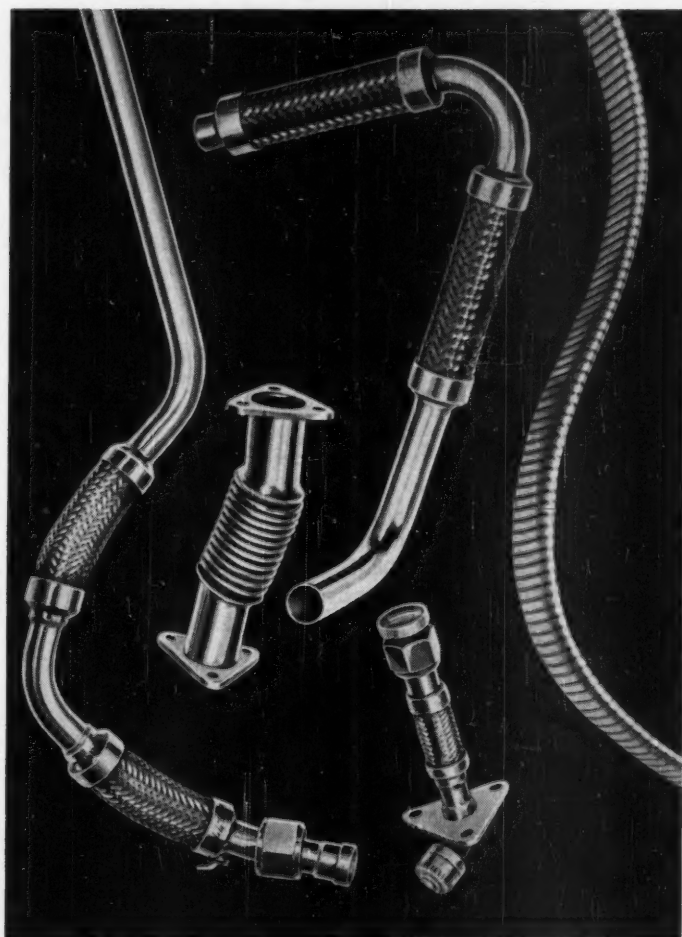
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CITYZONE.....STATE.....

Vinyl Coatings

- 1952:** Principal disadvantage—low build per coat.
Coating thicknesses of $\frac{3}{4}$ to 1 mil per coat usually the rule.
Five to six coats for required 5-mil thickness.
Not economical with this number of coats.
Best restricted to special applications.
- Now:** Two new developments entirely alter this picture.
They are (1) hot-spray, and (2) mastics.
Both yield easily applied coatings of 2 mils or more per coat.
Economical for general plant maintenance.
Formidable contenders.

Vinyl Coatings' Biggest Drawback Licked

RECENT announcements by manufacturers of vinyl coatings have stressed the increased thickness per coat now made possible. As more thickness per coat means fewer coats, cost of painting with vinyls is greatly reduced. With their inherent chemical resistance and improved adhesion, vinyls now assume the role of formidable coatings for use in chemical plant maintenance.

Here's how the biggest drawback—low build per coat—has been licked, and the pros and cons of the two new types with respect to each other.

Kenneth Tator, Kenneth Tator Associates, Coraopolis, Pa., is author of this article. See his *Protective Coatings Report*, Chemical Engineering, Dec. 1952, for background information about coatings. It tells why the 5-mil thickness is required for general maintenance painting in chemical plants, the desirability of a 3-coat system, etc.

Via Hot Spray

Painters know by experience that spray application of paint is much more effective when applied in hot weather. Under such conditions the paint needs little or no thinning to produce a good spray pattern. Paint flow-out is improved, as is the coverage. Conversely, in colder weather considerable thinner addition is required to obtain proper spray pattern—and both the thickness and quality of the deposited coat are adversely affected.

Addition of thinners to accomplish good spraying characteristics reduces the dry film thickness which can be obtained. This reduction in film thickness is caused not only by the reduction of film-forming solids. It is also caused by the fact that the thinned material has been made so much more fluid that its run-point on vertical surfaces is substantially lowered.

Adjusting the viscosity by warming, however, does not result in these reductions in coating thick-

ness. On the contrary, resulting thicknesses are substantially increased. This is due to the fact that the solvents and thinners in the coating composition will volatilize much faster from warmer material. An appreciable percentage of these solvents and thinners evaporate during atomization by the spray gun and during passage through the air to the surface being coated.

As a result, the deposited spray film is of higher viscosity and solids content, and its run-point is substantially increased. Thicknesses of conventional industrial vinyl coatings may be doubled when they are warmed prior to spraying.

While the use of equipment for the hot spraying of lacquers is relatively old, it is only within the past several years that paint heaters have become available and sufficiently portable to permit their use for industrial maintenance painting. Today lightweight, compact, electrically-powered heaters (which may be worn by the painter on a shoul-

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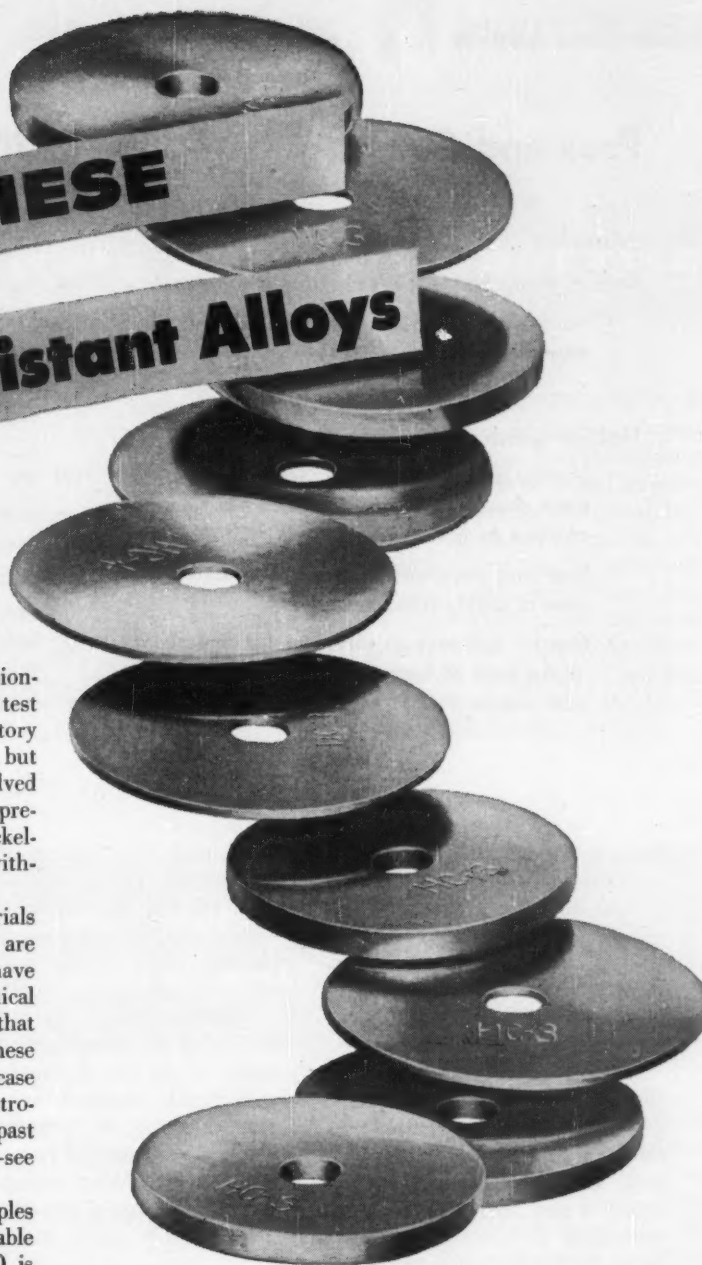
...and see for yourself
how economical they are

The only way you can be sure that a corrosion-resistant material will work in your plant is to test it under actual operating conditions. Laboratory tests will give you some idea of what to expect, but they don't show the effects of the variables involved in production operations. That is why we have prepared standard test specimens of HASTELLOY nickel-base alloys . . . and they are available to you without cost.

Test these alloys yourself against the materials you are now using, or against others that you are considering using. Prove to yourself that they have exceptional corrosion resistance . . . high mechanical strength, even at elevated temperatures . . . and that they are economical to use. We can support these claims with records of laboratory tests and with case histories of actual installations in chemical, petroleum, textile, and metalworking plants over the past 20 years. But don't take our word for it—see for yourself.

Use the handy coupon below to order your samples of HASTELLOY alloys. Alloys B, C, and F are available in either cast or wrought forms, while alloy D is supplied as castings only. If the equipment you have in mind is to contain welded joints, be sure to advise us, so that we may furnish you with welded samples.

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Pros and Cons

Mastics . . .

Better than hot sprays because:

- No additional equipment required over that normally used.

Not as good as hot sprays because:

- Shrinkage stresses and cracks are greater, since deposited wet film contains full portion of solvents and thinners.
- Seal coat necessary to reduce permeability in case of highly-filled mastics.
- Greater tendency to soften or lift undercoats in the case of high builds produced by more active solvents.

Hot Sprays . . .

Better than mastics because:

- Give desirable results with any conventional vinyl coating formulation.
- Coating may be more impervious and dense. (Not proved.)
- Shrinkage stresses and cracks are materially reduced due to lower volatile content of deposited wet film.

Not as good as mastics because:

- Additional equipment and electrical power lines to painting site are needed.
- Painters on high work are hampered by air and material hoses, also by electrical power line if using a belt type of heater or with additional material hose if using dolly-mounted recirculating pump heater.

der sling or attached to his belt) are available.* Available, too, is a recirculating heater combination with a paint pump (eliminating necessity for a pressure pot) mounted on a wheeled dolly.

Via Mastics

Another recent approach to securing adequate coating thicknesses with industrial vinyls was successfully arrived at through re-formulation. Obviously any development which would increase the solids content of the coating and/or decrease its fluidity when applied on vertical surfaces would result in coatings giving higher builds.

First attempt toward this objective was simply to omit portion of the volatile solvent normally used. This was unsatisfactory as the viscosity of the material increased much more rapidly than the solids content, producing a coating composition difficult to apply by brush or spray with inconsequential gain in coating thickness.

Perhaps the earliest successful vinyl "mastic" was a conventional industrial vinyl formulation in

which high filler loadings of short fiber asbestos and mica were added until the coating became a heavy pasty fluid. With this mastic composition, dried coating thicknesses of 3 to 5 mils are readily obtained.

However, due to the high filler loading of this composition, permeability of the film to moisture and corrosives is increased. It is therefore desirable to overcoat such vinyl mastics with a conventional unfilled vinyl. When sealed in this fashion, this type of high-filled vinyl gives entirely useful and satisfac-

tory performances as general maintenance protection. A three-coat system comprising a primer, an intermediate coat of this heavy vinyl mastic, and a conventional vinyl seal coat will dry to thicknesses in the order of 8 to 12 mils.

Third approach to this problem, also successful, is in retaining substantially the same type and proportion of vinyl resin and pigmentation while increasing the solids content by use of more active solvents. At least two prominent vinyl manufacturers have introduced successful formulations of this type. As these materials do not contain an appreciably increased filler loading, permeability of these compositions without sealing remains good.

With these vinyl mastics, dry film system thicknesses from between 8 to 14 mils may be readily obtained in three coats. No special equipment or application techniques are required for their use. Manufacturers of these materials recommend that a pump be used instead of pressure pot. While this helps, successful applications have been made with these materials using conventional spray equipment or by brushing.

NEXT MONTH:

PLASTIC VALVES . . .

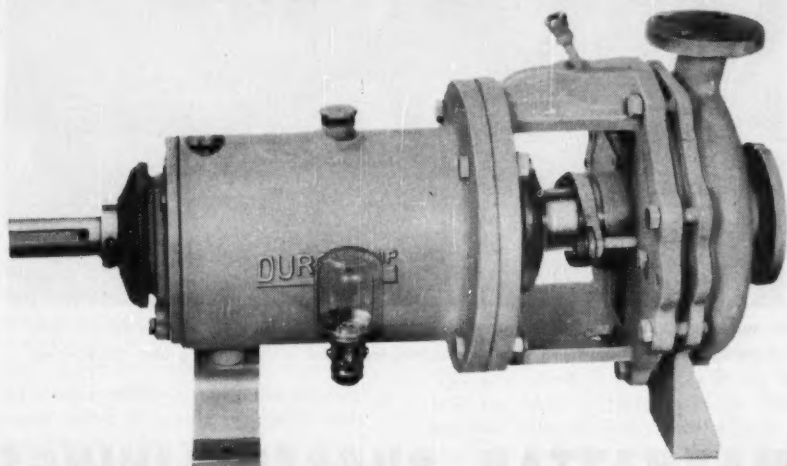
See the article by Ray Seymour, president of Atlas Mineral Products Co., on how plastics can be used to advantage in valves for corrosive service. It includes (1) what plastic materials are suitable and why, and (2) how individual plastics meet specific requirements of plug valves, globe valves, and diaphragm valves. Plastics to be covered include both thermosetting and thermoplastic types.

*Wright, B. C., *Chemical Week*, Oct. 23, 1954, p. 46.

all new SERIES

H DURCOPUMPS

NEW for heavy duty corrosion service



Series H DURCOPUMPS are all new, heavy duty chemical pumps. With a large, rugged shaft, heavy bearings, open or closed impeller and new features of adaptability, these pumps provide long, dependable pumping life with easy, low-cost maintenance. Designed for high heads and low capacities as well as for routine conditions, Series H Durcopumps can provide the answer to your tough pumping problems.

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3 BEARING
HOUSINGS
for
the
complete
range of
pump
sizes

The entire range of new Series H Durcopumps is accommodated by just three bearing housings and suitable adaptors. This unique feature coupled with the availability of eleven standard Durco alloys make the Series H DURCOPUMPS the most versatile chemical pumps ever developed.

Let us help you solve your difficult pumping problems.



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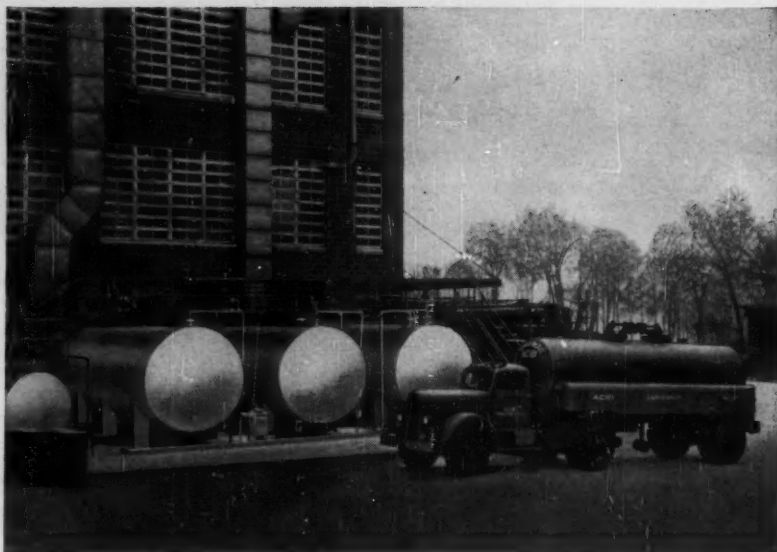
HOW TO BUY RUBBER LININGS

FOR PERMANENT PROTECTION AGAINST CONTAMINATION AND CORROSION

Insist on a tank lining job that assures an inseparable bond of rubber to metal. Get rubber lining that is applied by a company with complete facilities to handle any type of equipment, even the largest and most complex.

Wherever corrosive acids, salt solutions and other chemicals are constantly handled, your equipment needs the kind of protection possible only with specially compounded acid-proof rubber linings. Linings of thick, non-porous layers of rubber, rather than a mere film or coating, offer the lasting protection that lengthens the service life of your processing equipment. Make certain the rubber lining on your equipment is compounded to withstand changes in temperature . . . to resist abrasion, cracking and damage by corrosion. Where rubber lining presents a resilient, non-breakable surface bonded to the metal so securely it can't be separated, you can be sure your equipment has *permanent* protection against corrosion . . . your process solutions *positive* protection against contamination.

Entrust your lining job to the company with a long standing reputation for leadership in rubber lining techniques and facilities...specify Rubber Lining by Manhattan.



Manhattan Rubber-Lined tanks with interconnecting rubber-lined pipe used in muriatic acid storage. Each tank has own pumping system. Truck tank with its piping also rubber-lined.

MANHATTAN RUBBER LININGS

You get permanent, positive protection against losses from equipment corrosion and process contamination with Manhattan Rubber Linings. They are made from thick, calendered sheets of natural or synthetic rubber inseparably bonded to the metal by an exclusive Manhattan process for maximum durability. Manhattan Rubber Linings resist acids and alkalis . . . they expand and contract with the metal under extremes of temperature and will

not harden, crack or break under normal conditions of use. Every Manhattan Lined tank is tested under high voltage to make certain the protection of your equipment and processes is flawless and permanent. Because Manhattan has the most modern and complete lining facilities available today, they can handle your job regardless of its size or complexity. Contact the R/M representative at the Manhattan Rubber Lining plant nearest you.

RUBBER LINING PLANTS AT PASSAIC, N.J. and NORTH CHARLESTON, S.C.

MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.



Flat Belts



V-Belts



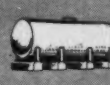
Conveyor Belts



Hose



Roll Covering



Tank Lining



Abrasive Wheels

Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Brake Linings • Brake Blocks • Clutch Facings
Asbestos Textiles • Packings • Engineered Plastic, and Sintered Metal Products • Bowling Balls

Here's why I-R CHEMICAL PUMPS always give you Better Service

They are **ARMORED**
AGAINST CORROSION

with **IRCAMET**

Ingersoll-Rand chemical pumps are built to stand up under the continuous handling of corrosive and abrasive liquids. All parts that come in contact with the liquid are made of IRCAMET—a high nickel-chromium-molybdenum alloy steel developed exclusively by I-R for chemical pump service. Laboratory tests and years of field experience have proved its exceptional ability to resist the corrosive action of a wide variety of acids and alkalis. Other materials are available for special conditions. The entire unit is further protected by special paint which is highly resistant to chemical action.

They are **PROTECTED**
AGAINST LEAKAGE

with the
LEAKOLLECTOR

The patented LEAKOLLECTOR stuffing-box gland—an exclusive feature of all I-R chemical pumps—provides a simple and effective solution to the problem of pump leakage.

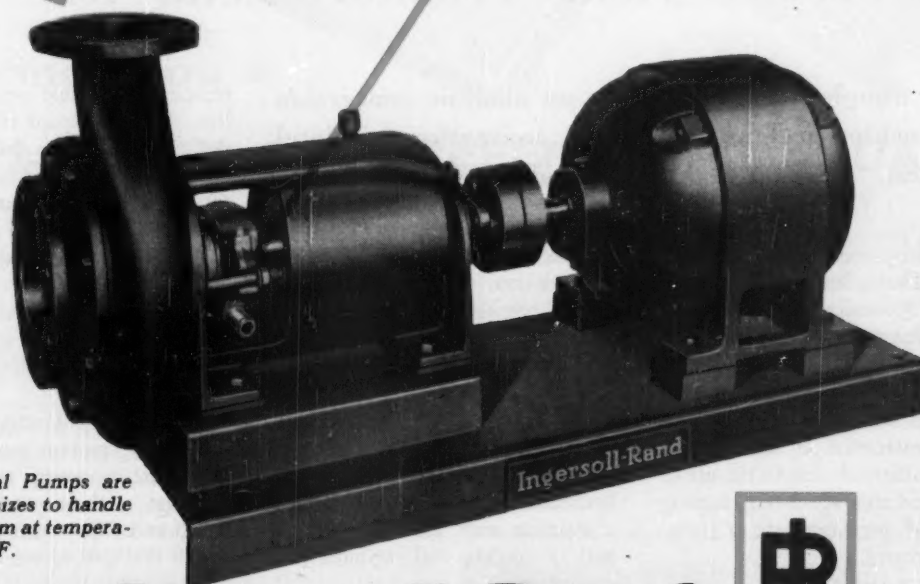
It completely encircles the stuffing box, trapping all leakage so that it can be drained away for collection or disposal. The split gland is accurately fitted to both the inside and outside of the box, and will catch any seepage escaping between the shaft and packing, or between the packing and the bore of the box. The LEAKOLLECTOR is easily removed from the shaft for repacking the box.

They are **BUILT FOR**
EASY MAINTENANCE

and **LESS OF IT**

These pumps are ruggedly constructed to last longer on the job—and the simple design, with all parts easily accessible, means less "time out" for maintenance. The short, rigid stainless-steel shaft prevents impeller whip and eliminates many stuffing-box troubles. The suction nozzle is removable, permitting access to the impeller without disturbing the discharge piping.

THE CAMERON MECHANICAL SHAFT SEAL can be installed on all I-R chemical pumps in place of the conventional stuffing-box. It eliminates stuffing-box leakage and requires practically no attention or maintenance.



I-R Chemical Pumps are available in sizes to handle up to 4000 gpm at temperatures to 800°F.

Ingersoll-Rand



10-203

Cameron Pump Division

11 Broadway, New York 4, N. Y.

PUMPS

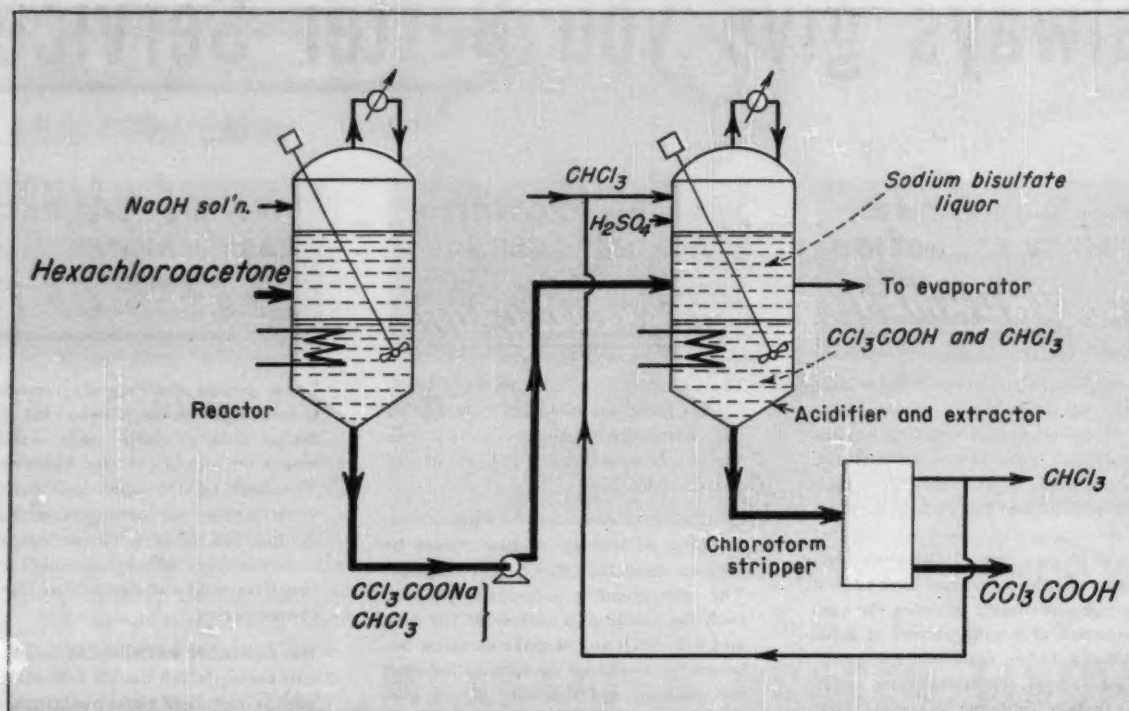
CONDENSERS

TURBO-BLOWERS

COMPRESSORS

AIR & ELECTRIC TOOLS

ROCK DRILLS



New Process Yields Trichloroacetic Acid

Simple technique hinges on alkaline conversion of hexachloroacetone instead of conventional chloral oxidation. Results: higher yields at lower cost.

Hexachloroacetone instead of chloral. That's the starting material in Allied Chemical & Dye Corp.'s new process for the manufacture of trichloroacetic acid. And unlike conventional chloral oxidation, the method is said to eliminate:

- Destruction of some of the charging material—due to the use of strong oxidizing agent (e.g. fuming nitric acid, permanganate or potassium chlorate).
- Low yields.
- Expensive operation—due to costly reactants.
- Difficult product separation and recovery—due to the presence of contaminants.

Allied's process involves a two-step reaction. First, hexachloroacetone is converted—by the addition of aqueous NaOH—to chloroform and the sodium salt of trichloroacetic acid. Then, the sodium salt is acidified with excess H_2SO_4 to liberate the free acid.

► **Alkaline Conversion**—As shown, hexachloroacetone is charged into a stainless steel reactor equipped with a cooling coil, agitator and condenser.

Next, an equimolal aqueous solution of sodium hydroxide is slowly added to the ketone at a rate sufficient to maintain a reaction temperature of about 25-30 C. The

temperature should never drop below 0 C. nor exceed 60 C. Below 0 C., the reaction is slow and hexachloroacetone solidifies. Above 60 C., sodium trichloroacetate decomposes.

Sodium hydroxide addition takes about one hour. But agitation is continued for at least another hour—or until titration of a water layer sample shows complete consumption of alkali.

Part of the chloroform liberated during the reaction vaporizes. The vapors are condensed and returned, as reflux, to the reactor.

► **Salt and Chloroform Recovered**—If salt and chloroform are to be recovered as end products, the aqueous and organic layers in the reactor are allowed to settle. The lower (chloroform) layer is then withdrawn and stored. The upper (aqueous salt) layer is also withdrawn and stored

New...

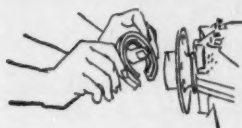
*for machine designers
and users...*

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leading manufacturers have profited from the superior performance of Clipper Seals. Full use is made of every type of illustration for complete descriptions of important applications. Close-up photographs show how to install split Clipper Seals in limited space.

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or, if desired, sent to an evaporator to recover solid sodium trichloracetate.

► **Acid Liberation**—If trichloroacetic acid is the desired end product, the aqueous-organic reaction mixture is pumped into an acidifying and extracting chamber.

Here, 90-95% sulfuric acid is gradually added (1:1 molar ratio of acid salt: acid) to the reaction mixture—with agitation and cooling. Acidification is rapid and usually complete by the time all the acid is added (about one hour). However, to insure complete reaction, agitation is continued for another half hour.

At the end of this time, the mixture is allowed to settle into two layers—an upper layer of aqueous sodium bisulfate, a lower layer of trichloroacetic acid dissolved in chloroform. About 95% of the trichloroacetic acid is dissolved in the lower layer; the rest, in the upper layer.

► **Bisulfate Important**—An important feature of the process is the acidification of the sodium trichloroacetate to the bisulfate stage.

In carrying the acidification to this stage, reaction products are recovered as liquids, i.e. free of solid precipitates such as sodium sulfate or chloride. And from the economic angle, the bisulfate has a much greater value than either the sulfate or chloride.

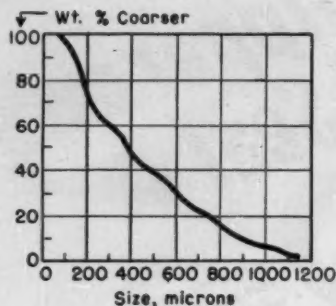
► **Chloroform Stripped**—The lower (chloroform) layer—containing better than 95% of the trichloro acid—leaves the acidifier and goes to a chloroform stripper. This may be any conventional evaporator or column (equipped with the usual reboiler section) which will vaporize the low-boiling chloroform.

Recovered CHCl_3 is quite pure and, after minor conventional purification, may even be used for drug and medicinal purposes. Trichloroacetic acid, also quite pure, discharges from the bottom of the column to storage bins or to a crystallizing tank.

► **Extra 2-3% Recovered**—Although the upper bisulfate layer contains less than 5% of the total acid yield, half of this amount can be recovered.

A volume of chloroform equal to the volume of bisulfate liquor is added to the acidifier. The chloroform-bisulfate liquor is then agitated and allowed to settle into two layers. The lower (chloroform) layer—containing 2-3% trichloro acid—is withdrawn and sent to the stripper.

The upper (bisulfate) layer is discharged to an evaporator to recover solid sodium bisulfate.—U. S. 2,695,918 by Everett E. Gilbert, Donald H. Kelly and Cyril Woolf to Allied Chemical & Dye Corp.



Glass Beads Used In Sieve Calibration

Here's a novel method for calibrating sieves—especially those which are non-uniform. The new technique makes use of calibrated glass bead samples—of known particle size distribution—to calculate the effective (rather than average) sieve opening.

► **Weigh, Shake, Weigh**—First, the calibrated sample is carefully weighed and placed on the sieve. Then, the sieve is shaken until the rate of passage of beads through it is almost zero.

After shaking, beads that have passed through the sieve are weighed. And the weight of beads retained on the sieve is calculated by subtracting the weight passing through from the initial sample weight.

► **Direct Reading**—Effective sieve opening is then read directly from a plot of weight percent of retained beads (coarser than the sieve) vs. opening (microns). Thus, if 20% of the sample did not pass through the sieve, the effective opening is 750 microns.

The inventors claim that two sets of sieves calibrated by this technique gave the same analysis of an unknown sample. (The analyses would have varied had they been based on nominal sieve opening.)

A method of calibrating the glass beads is cited in the patent.—U. S. 2,693,706 by Frank G. Carpenter and Victor R. Deitz to the Sec. of Commerce.

Interested in Anhydrous Hydrazine?

Azeotropic distillation—with aniline, benzene, n-hexyl alcohol, phenol, pyridine, toluene, xylene or xylidine—is the key to a new method for dehydrating hydrazine solutions.

Overhead from the distillation column is an azeotropic mixture of solvent and water. Bottoms—hydrazine-rich aqueous solution—go to a fractionating column for recovery of anhydrous hydrazine.—U. S. 2,698,286 by John R. Bircher, Jr. to Battelle Development Corp.

Another Way to Separate Phthalic Acid Isomers

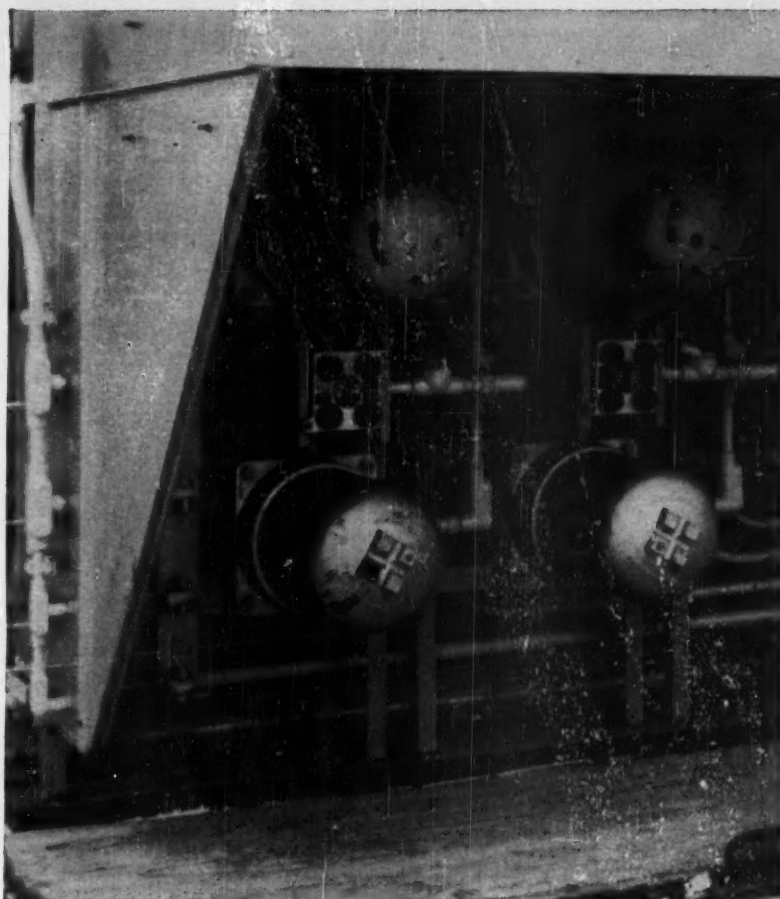
For the second time in five months (*Chem. Eng.*, p. 240, January '55) we have a new method for separating phthalic acid isomers from the California Research Corp.

And like the method previously described, the new one deals with the separation of isophthalic from terephthalic acid rather than with the separation of their respective precursors, *m*- and *p*-xylene.

The new technique is based on the discovery that terephthalic acid's alkali metal salt is practically insoluble in a saturated aqueous so-

This department is a digest of recently issued patents, selected and evaluated for you by Dr. Melvin Nord, Chemical Engineer and Patent Attorney, 17600 Pinehurst, Detroit 21, Mich.

Any patents may be ordered from the Commissioner of Patents, Washington 25, D. C. The cost: 25 cents.



TRI-NONs monitor CO, CO₂ in feed streams at Cyanamid's Fortier Ammonia unit.

TRI-NON* Analyzers lengthen time between turnarounds... reduce operating costs

In addition to providing important analytical control on process streams, continuous infrared analyzers can be a highly important factor in preventive maintenance. Where product mix conditions in a process stream may lead to fouling, catalyst poisoning, afterburning, etc., analyzers will give immediate warning of such conditions in time to take corrective steps.

FOR EXAMPLE, the two TRI-NON Analyzers at American Cyanamid Company's new Fortier plant protect the catalyst in the ammonia reactor from poisoning by oxygen compounds, thus reducing risk of costly shut-downs. In another unit, TRI-NON Analyzers are used to monitor the feed composition going to the acetylene burners so as to maintain

smooth operation and desired acetylene concentrations in the burner exit gas.

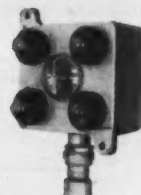
Many refineries have installed analyzers in the off-gas of "cat" crackers to follow CO concentrations, since an increase in this gas is an accurate, early indication of the development of an afterburning condition.

Perkin-Elmer TRI-NON Analyzers are available in a wide range of models and prices to meet all types of continuous analytical problems. They are rugged and dependable, expressly designed for use in the varied environments of the processing plant or refinery. And they are backed by Perkin-Elmer's experienced engineers who are ready to provide expert guidance in their application and installation.

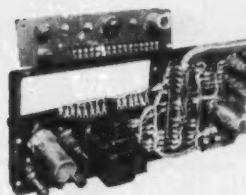
These TRI-NON features...



- Sound Principles and Sturdy Design



- On-Stream Component Testing



- Rapid Interchange of Components

...add up to depend-
ability plus quick
and easy maintenance

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lution of the same alkali metal salt of isophthalic acid.

For example, although the solubility of sodium terephthalate in water (at 25 C.) is 14 wt. %, its solubility in a saturated sodium isophthalate solution is less than 0.2%.

► **Salts in Water**—Thus, the mixture of acids is first converted to the sodium or potassium salts. Then water is added—in four steps:

- Insufficient to dissolve all the salts.

- Insufficient to dissolve all the salts and all of the more

soluble alkali metal isophthalate.

- Insufficient to dissolve all the salts, but enough to dissolve all the alkali metal isophthalate plus part of the alkali metal terephthalate.

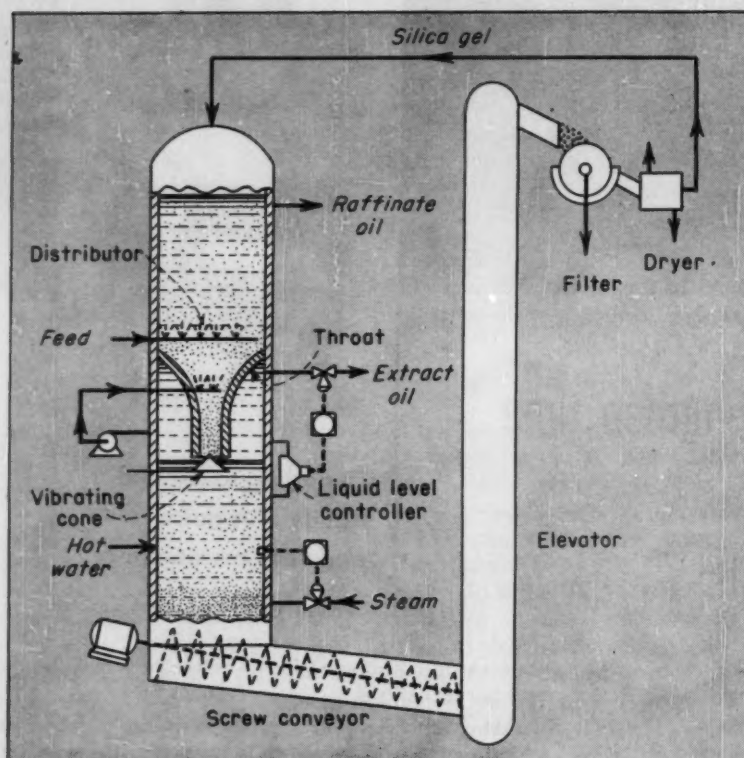
- Insufficient to dissolve all the salts, but just enough to dissolve all the alkali metal isophthalate.

In the first step, pure isophthalate salt, terephthalate salt or both are obtained. In the second, the liquid phase consists of essentially pure alkali metal isophthalate in saturated aqueous solution. (The

alkali metal terephthalate is almost completely insoluble in such a solution.)

In step #3, the solid phase separated from the aqueous mixture consists of almost pure alkali metal terephthalate. And finally—in step #4—an almost complete separation of alkali metal isophthalate and terephthalate into their pure components is obtained.

Applications of the basic method are cited in the patent.—U. S. 2,698,723 by Earl F. Carlston and Funston G. Lum to California Research Corp.



Novel Unit for Continuous Adsorption

Something old and something new are combined in this novel continuous adsorption process for the fractionation of liquid organics.

- Old—silica gel adsorbent.
- New—a two-in-one column.

The process is carried out in a tower consisting of two sections

separated by a funnel-shaped throat and vibrating cone. The upper section is the adsorber; the lower, the desorber.

Liquid feed (narrow-boiling, paraffin-aromatic mixture) enters the tower—via a distributor—at the top of the throat. And a heated

stream of finely-divided silica gel feeds continuously into the top of the adsorbing section.

► **Adsorption**—The gel particles fall countercurrent to the charge, adsorbing aromatics on their way down.

Unadsorbed paraffins move up through the adsorbing section, leaving as raffinate overhead. This raffinate oil cools the silica gel as it descends through the tower.

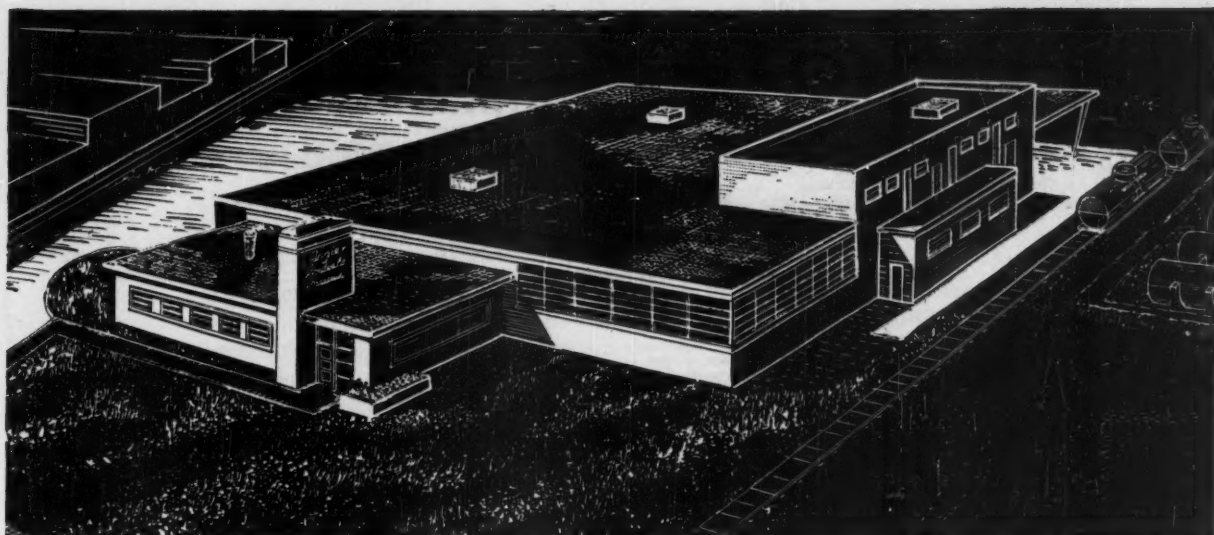
► **Desorption**—As the gel moves down through the throat—and into the desorbing section—its rate of flow is controlled by the speed of the vibrating cone.

Highly-dispersed gel drops from the throat countercurrent to an immiscible desorbent (water) fed near the bottom of the desorbing section. The gel adsorbs the water and desorbs the aromatics.

Lighter-than-water aromatics rise in the desorbing section and leave as extract. (A liquid level controller maintains the oil-water interface just a few inches below the bottom of the throat.)

Part of the extract is recycled to a point midway down the throat. Some of it serves as reflux for the adsorbing section; the rest flushes adsorbent down the throat.

Silica gel exits from the bottom of the tower via a screw conveyor. It is then elevated and sent to a rotary filter and dryer (to remove water). Regenerated gel is returned to the top of the tower.—U. S. 2,696,305 by James V. Slover to Phillips Petroleum Co.



Your Huntington, Indiana Source for Adhesives and Coatings is now ready

In effect, Angier's modern facilities at its new midwestern plant are *yours* also. Because "custom" manufacturing of adhesives, coatings and sealants will go on there just as it has for over 20 years at the home plant in Cambridge, Mass.

For a variety of reasons involving time and money, you may prefer the Huntington, Indiana location to the Cambridge location. Just remember that Angier is now able to make overnight delivery to all Eastern and Midwestern major cities.

Will an adhesive or coating improve the end-use of your product or cut its production costs? Angier will find the answers for you in surprisingly short time.

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Latest Developments
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Midwestern Plant: Huntington, Indiana

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Your Checklist of New Equipment Patents

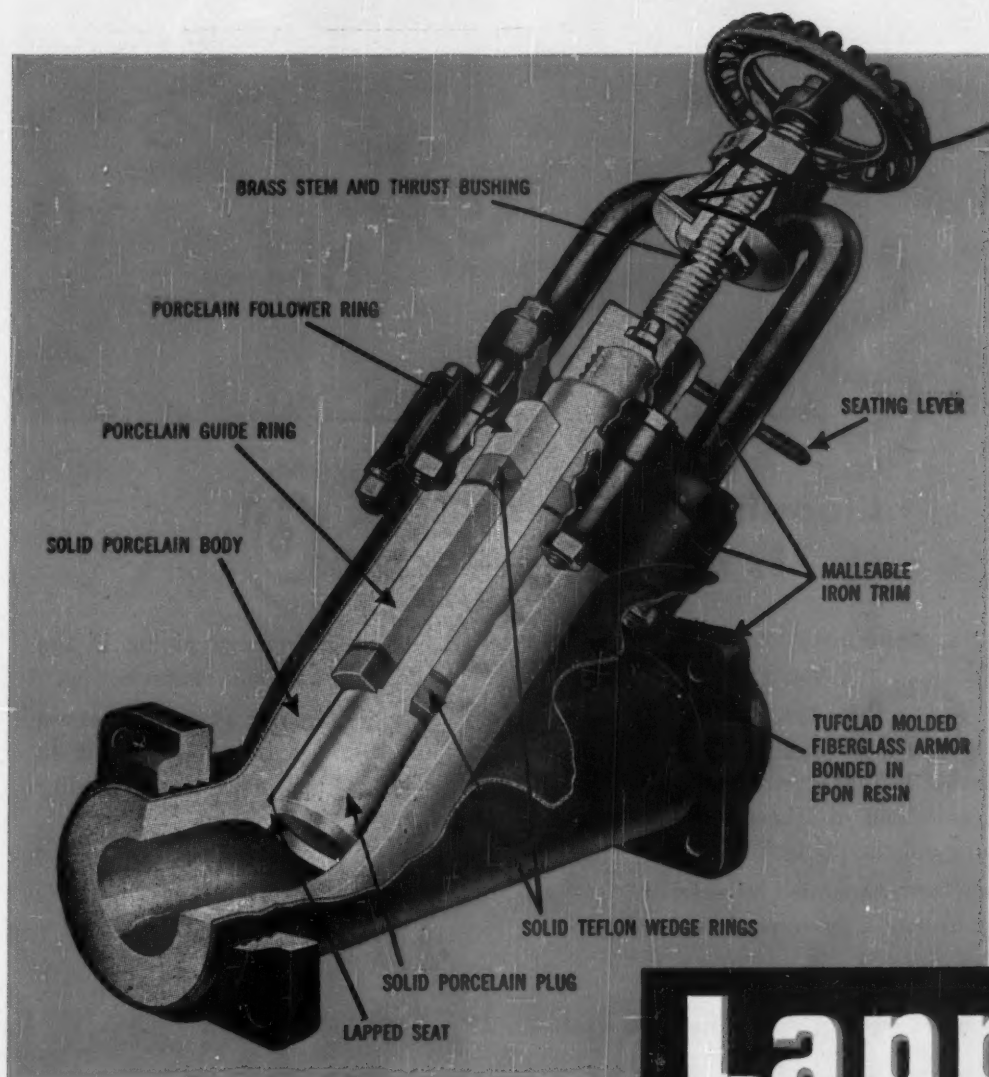
Operation . . .	About . . .	Inventor or Assignee . . .	Patent No. . .
Chemical reaction.....	Sulfonator.....	Universal Oil Products Co.....	2,697,031
Crushing and grinding.....	Feed control for hammer mills.....	Bank of Salem (Va.).....	Re 23,903
	Bowl mill.....	Combustion Engineering, Inc.....	2,698,142
	Pulverizing mill.....	Combustion Engineering, Inc.....	2,699,293
	Vacuum distillation of oils.....	Phillips Petroleum Co.....	2,698,282
Crystallisation.....	Distillation column with central downcomer.....	David G. Reynolds.....	2,698,746
Distillation.....	Continuous centrifugal crystal purifier.....	Phillips Petroleum Co.....	2,696,307
	Apparatus for distilling high-boiling organic liquids.....	Metalgesellschaft A. G.....	2,695,869
	Ammonia distillation set-up.....	Carl Otto.....	2,695,870
	Rotary molecular vacuum still.....	Abbott Laboratories.....	2,695,871
Drying.....	Antibridging device for flash-drying chamber.....	Swift & Co.....	2,697,486
	Spray dryer.....	Instant Drying Corp.....	2,698,815
Extraction.....	Desolventiser.....	French Oil Mill Machinery Co.....	2,695,459
	Extractor for separating materials of different solubilities.....	Jose A. Luque.....	2,699,379
Extrusion and molding.....	Injection molder.....	M&W Co., Inc.....	2,698,460
	Extrusion of molten plastic.....	E. I. du Pont de Nemours & Co.....	2,698,463
	Pressure-controlled extruder.....	Modern Plastic Machinery Corp.....	2,698,964
Filtration.....	Filter cake washer.....	Karl Weinhold.....	2,698,687
	Filter media for drum filter.....	Thomas R. Komlins.....	2,699,260
Fluid and particle flow.....	How to displace hydrocarbon vapors from spent fluidized catalyst.....	Phillips Petroleum Co.....	2,697,881
	Device to prevent catalyst backflow.....	Phillips Petroleum Co.....	2,698,224
	Solids flow regulator.....	The Lummus Co.....	2,698,740
	Elevating granular material.....	Houdry Process Corp.....	2,699,363
Heat transfer.....	Heat exchange system for fluidized bed reactors.....	Standard Oil Development Co.....	2,697,334
	Controlled-temperature, fan-cooled heat exchanger.....	The Fluor Corp., Ltd.....	2,697,587
	Interlocking finned heat exchange envelope.....	The Air Preheater Corp.....	2,697,588
	Contacting vapors and fine solids in tower rigged with heat exchanger.....	Standard Oil Development Co.....	2,697,653
	Pebble heater.....	Phillips Petroleum Co.....	2,698,350
	Cooling naphthalene-containing gas.....	Rosenblad Corp.....	2,699,225
	Heat exchanger.....	Henry H. Feldstein.....	2,699,322
	Plate-type heat exchanger.....	The A.P.V. Co. Ltd.....	2,699,324
	Pebble heater for hydrocarbons conversion.....	Phillips Petroleum Co.....	2,699,380
Instrumentation and control.....	Level indicator for granular solids.....	Sun Oil Co.....	2,696,114
	Vibrating plate viscometer.....	Radio Corp. of America.....	2,696,735
	Magnetic flowmeter.....	Erco Engineering Corp.....	2,696,737
Solid-gas separation.....	Electrostatic precipitator.....	Westinghouse Electric Corp.....	2,696,893
	Separating solids from gas by centrifugal force.....	Research Corp.....	2,696,895
	Separating airborne particles.....	Vokes Ltd.....	2,696,911
	Electrical precipitator.....	Research Corp.....	2,698,669
	Cyclone separator.....	Standard Oil Development Co.....	2,698,672
	Electrode rapping system.....	Research Corp.....	2,699,224
Solid-solid Separation.....	Drum separator.....	Western Machinery Co.....	2,696,300
	Classifier for material reduction mills.....	David Weston.....	2,696,908
	Revolving current flotator.....	Charles M. Anderson.....	2,696,913

. . . And New Process Patents

Product . . .	Process . . .	Inventor or Assignee . . .	Patent No. . .
Carbon.....	Oil pelleting of carbon black.....	Phillips Petroleum Co.....	2,699,381
Fats and oils.....	Producing conjugated fatty acids.....	General Mills, Inc.....	2,698,857
Gases.....	Air fractionation.....	Air Products Inc.....	2,697,922
	Acetylene manufacture.....	Union Oil Co. of Calif.....	2,698,349
	Manufacture of krypton and xenon.....	Carthage Hydrocol, Inc.....	2,698,523
	Producing SO ₂ -containing gases by roasting sulfide-containing iron ore.....	Badische Anilin- & Soda-Fabrik A. G.....	2,699,375
Hydrocarbons.....	Shale distillation.....	Standard Oil Development Co.....	2,697,688
	Destructive distillation of shale.....	A/B Svenaka Maskinverken.....	2,698,283
Inorganic chemicals.....	KOH production.....	International Minerals & Chemical Corp.....	2,699,377
Metals and ores.....	Recovery of nickel and copper values from copper ammonium carbonate leach solutions.....	Calumet & Hecla, Inc.....	2,698,220
Organic chemicals.....	Benzene sulfonation.....	Allied Chemical & Dye Corp.....	2,697,117
	Chlorinating diethyl ether.....	Allied Chemical & Dye Corp.....	2,697,119
	Cumene hydroperoxide preparation.....	Soc. des Usines Chimiques Rhone-Poulenc.....	2,697,121
	Isolating phenolic epds. from mixtures of phenol, cresols, xylenols and ethylphenols.....	The Texas Co.....	2,697,122
	Ethylene oxide manufacture.....	Oxirane Ltd.....	2,697,104
	Lower alkyl esters of monohaloacetic acid from ketene, halogens and alcohols.....	Eastman Kodak Co.....	2,697,115
	Producing higher ketones.....	Shell Development Co.....	2,697,730
	Ethanol from acetone.....	Stanolind Oil & Gas Co.....	2,698,346
	Manufacture of halogen epds.....	Ethyl Corp.....	2,698,347-8
	Alcohol from vegetable starch.....	Merco Centrifugal Co.....	2,698,826
	Diethylketone production.....	The Texas Co.....	2,699,453
	Ethylene polymerization.....	Karl Ziegler et al.....	2,699,457
Pigments.....	Preparation of phthalocyanine pigments.....	American Cyanamid Co.....	2,699,440 & 2,699,442-4
Resins.....	Preparation of polyurea resins.....	Rohm & Haas Co.....	2,699,435
Synthesis gas and products.....	Manufacture of hydrogen-rich gas.....	The M. W. Kellogg Co.....	2,697,655
	Synthesis gases preparation.....	E. I. du Pont de Nemours & Co.....	2,697,696
	Alcohols synthesis.....	Standard Oil Development Co.....	2,697,731
	Synthesis gas from coal.....	E. I. du Pont de Nemours & Co.....	2,698,227
	Hydrocarbon synthesis.....	Standard Oil Development Co.....	2,698,335
	CO hydrogenation—using an alloy catalyst.....	Standard Oil Co. (Ind.).....	2,698,862
	Synthesis gas manufacture.....	Gulf Research & Development Co.....	2,699,383

A "cushioned" porcelain-to-porcelain seal in the Lapp Valve

The chemical resistance qualities of the Lapp Valve come from the fact that the body and plug are both *solid porcelain*. Porcelain, as a material, however, has little resiliency or "give" when the plug hits the seat in the body. Special spring-loaded "cushion" seating in Lapp valves prevents damage from a heavy-handed operator, and warns when seal is tight. Built into the thrust bushing of every Lapp Y-valve and angle valve, is an arrangement of tempered Beryllium copper spring washers. This spring loading also provides that a closed valve will maintain its tightness even under vibration and thermal movement of parts.



V-valves, angle valves, flush valves, safety valves, and plug cocks of Lapp Porcelain have standard bolt-circle flanges for easy connection to all piping and equipment. Write for bulletin with complete description, characteristics, and specifications. Lapp Insulator Co., Inc., Process Equipment Division, 414 Wendell St., Le Roy, N. Y.

Lapp

PROCESS EQUIPMENT

Chemical Porcelain Valves • Pipe • Raschig Rings
Pulsafeeder Chemical Proportioning Pumps





TOP HAT QUALITY

Cleaning the SPARKLER MCR is a white collar job

Take the heavy dirty work out of filter cleaning and you have speed and efficiency that will be a revelation in lower operating cost.

With the Sparkler MCR, there is no messy job of breaking pipe connections or laborious hand winch work in pulling out the plates.

The smooth, clean, power operated retractable tank exposes the plates for easy accessibility in

cleaning. Supply and discharge piping in the fixed head remain intact without disconnecting.

Here is a heavy duty filter that purrs like a kitten when filtering and is smooth as silk to clean. Top hat quality in a filter for top quality products.

Write Mr. Eric Anderson for personal engineering service on your filtration problem

SPARKLER MANUFACTURING CO.

MUNDELEIN, ILL.

• Sparkler International Ltd. • Plants at,
Galt, Ontario, Canada; Amsterdam, Holland.

For over a quarter of a century, engineers and manufacturers of a complete line of industrial filtration equipment.



Retractable Tank Model MCR filter
available in capacities from 100 sq.
ft. to 2000 sq. ft. of filtering surface.

CHEELOX B-14

*The Balanced
Organic
Sequestering
Agent*

Specifically designed to inactivate CALCIUM and MAGNESIUM PLUS all traces of IRON. In alkaline processing liquors, calcium and iron sequestering is accomplished SIMULTANEOUSLY.

CHEELOX B-14 is the new, all-purpose chelating agent which is soluble and stable at all temperatures in neutral, acid and alkaline solutions. For economical control of metal ions, regardless of the problem, Cheelox B-14 is the product to use.

To determine the effectiveness and economy of Cheelox B-14, we suggest you compare this new sequestering agent with the product you are now using.

Send today for a sample and technical data on the uses of Cheelox B-14.

From Research to Reality

ANTARA CHEMICALS

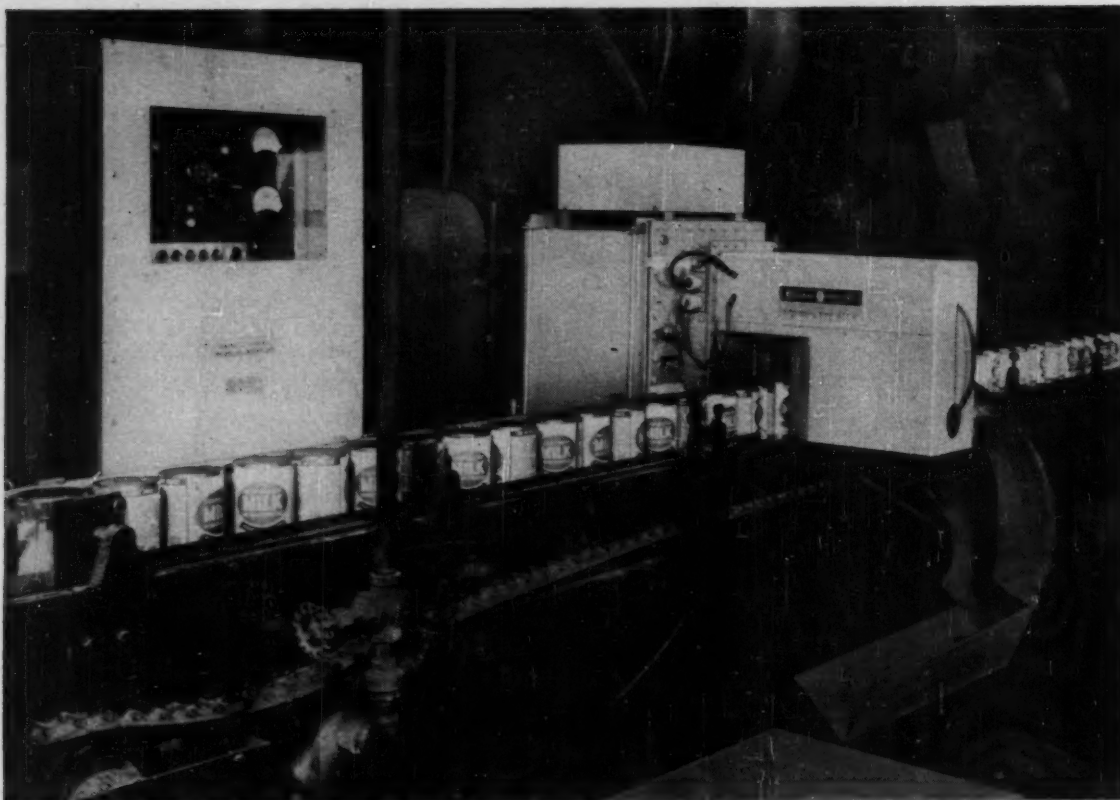
A SALES DIVISION OF GENERAL ANILINE & FILM CORPORATION
435 HUDSON STREET • NEW YORK 14, NEW YORK

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Portland, Ore. • San Francisco • Los Angeles • IN CANADA: Chemical Developments of Canada, Ltd., Montreal

ANTARA



NEW PACKAGING & HANDLING EQUIPMENT



FINAL ASSURANCE of accurate filling on container line gained with new level-checking device that can . . .

Check Fill Faster and Cheaper With X-Ray

Fifteen containers per second are accepted or rejected. Device triples capacity and increases accuracy at half the usual investment for such equipment.

People are always interested in raising throughput, without increasing size of processing equipment. If, at the same time, they can do it with less capital investment that's a real gain.

From installations already operating comes confirmation that the Hytafill level checker lives up to such a billing.

Previously, level checkers had a top limit of 350 containers per min. Now, the same conveyors can be stepped up to a rate of 900 units

per min. with full assurance that Hytafill will reject containers whose fill level varies by more than $\frac{1}{8}$ in. And at a cost of approximately \$3,000 it is one half the usual price for a high-capacity weighing-type checker.

► **No Contact With Can**—Hytafill operates by projecting a very narrow x-ray beam across the conveyor whenever a can moving away from the filling equipment interrupts its photoelectric beam. Height of the x-ray beam is adjusted to the de-

sired fill level, can be set to check overflow, underfill or both.

Incorrect fill alters the x-ray beam sufficiently to register on a crystal detector. The amplified signal from the detector triggers the rejecting device which kicks the off-standard container off the conveyor.

There is no radiation problem for the user. The x-ray beam is quite small and the device is shielded completely.

► **Compact and Trouble-Free**—Very little space is needed for the Hytafill level checker. The detector can be mounted on a solid supporting platform 12 by 17 in. The small control unit can be set up

Now - - - this
dependable
pump
fits many more
applications

In the past eight years the chemical industry throughout the world has seen LaBour Type G hang up record after record for uninterrupted service and low or non-existent cost for repair parts. Now this revolutionary packingless, self-priming centrifugal pump becomes even more useful because the new Type CG can handle flooded suction applications as well as the suction-lift conditions to which former Type G pumps were restricted.

Other advantages have been added, also, including closure of the dynamic seal to prevent escape of toxic gases, and the ability to flush the seal at will during normal operation.

Get the whole story in Bulletin G-1. Ask us to send your copy — today.



ORIGINAL MANUFACTURERS OF THE SELF-PRIMING CENTRIFUGAL PUMP

LA BOUR

THE LA BOUR COMPANY, INC. * Elkhart, Indiana, U.S.A.

Newsworthy Equipment This Month

Page number is also Reader Service code number

New Packaging & Handling Equipment

Container Level Checker.....	244A
Feeder-Conveyor	246A

New Processing Equipment

Porous Metal Filters	248A
Dry Blender	248B
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Water Conditioner	248D
Extraction Plant	248E
Chlorinator	250A
Centrifugal Nozzle	250B
Polyethylene Vessels	250C
Homogenizer	250D

New Heating & Cooling Equipment

Packaged Boiler	252A
Sulfur Cooler	252B
Cooling Tower	252C

New Instruments & Controls

Pneumatic Receiver	254A
Facilities Control	254B
Safety Regulator	254C
Load Elements	254D
Toggle Valve	254E

New Safety Equipment

Protective Hood	256A
Radioactive Gas Filter	256B
Emergency Oxygen	256C
Chemical Goggle	256D

New Fluids Handling Equipment

Slurry Valve	258A
Air Filter	258B
Low-Rate Feeder	258C
Proportioning Pump	258D
Air Filter	258E

Equipment Cost Index, p. 248

For more details, use Reader Service Card

anywhere within 50 ft. of the detector.

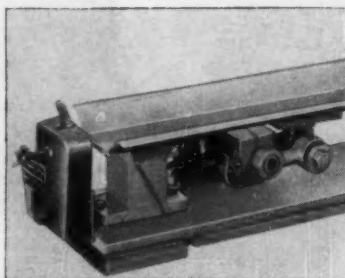
Once controls are set initially, you only need to switch the level checker on or off as needed. Cleaning is easy since both components can be washed down with either steam or water.

Unlike mechanical devices, which have many moving parts that are subject to wear, the Hytafill has only a moving shutter to operate the x-ray beam. It needs no attendance, requires little or no conveyor adaptation and works with existing equipment.

► **Eliminates Flow Stoppage**—This type level checker eliminates flow stoppages such as commonly encountered when trouble develops with mechanical weighing checkers. With Hytafill checking at rates up to 15 per sec., failure of the unit will not interfere with flow of production since there is no mechanical contact.

► **Products Handled**—Hytafill can check level of virtually any liquid or free-flowing solid. To date, it is being used to monitor the fill in cans of liquid detergent, beer, soft drinks, evaporated milk and

citrus fruit juices. It is being used on a chemical application by one branch of the armed services. And it is well suited for products such as oil, cleaning fluids, paint, insecticides, chemicals and liquid waxes and cleaners.—General Electric Co., X-Ray Dept., 4855 Electric Ave., Milwaukee 1, Wis. 244A



Feeder-Conveyor

Mounted on rubber-encased steel for durability and gentle handling.

Outstanding feature of the new Resilient-Flow feeder-conveyor is the spring mounting. The mechanically-vibrated unit is supported on blocks of neoprene, 3 in. high.

A metal strip is permanently imbedded in each neoprene mount at an angle 60 deg. from the horizontal. This forces all movement in the mounts to take place at an angle 90 deg. from the linear direction of the strip. In turn, angle of conveying throw is 30 deg.

Such mountings are considered equivalent to hermetically-sealed bearings. Maintenance problems are minimized.

Conveying speed can be varied by remote control from one to 60 ft. per min. Gentle vibrating action handles delicate materials without damage. Abrasive materials can be moved with minimum pan wear. Feeds up to 150 tons per hr.; conveys up to 20 tons per hr.—Carrier Conveyor Corp., Frankfort Ave., Louisville, Ky. 246A

For More Information...



about any item in this department, circle its code number on the Reader Service

Postcard inside the back cover.

*We've found that "KARBATE" equipment cuts costs
wherever corrosion is a factor!*



WHY SHOULD YOU USE

KARBATE

BRAND

IMPERVIOUS GRAPHITE PROCESS EQUIPMENT?

**ANSWER: Because only "Karbate"
products combine:**

- Corrosion resistance
- Immunity to thermal shock
- Freedom from metallic contamination
- High thermal conductivity
- Low first cost and low maintenance
- Workability — readily fabricated and serviced in the field
- Sturdy, durable constructions
- Standard stock units
- Complete technical service

Manufactured Only By National Carbon Company

"Karbate" impervious graphite is a "must" in many highly corrosive services. But these applications only begin to measure the possibility of savings offered by "Karbate" products in a wide range of process locations. Wherever corrosion, contamination or thermal shock must be eliminated, "Karbate" products save time and money all the way down the process line.

WRITE FOR LITERATURE!

*The term "Karbate" is a registered trade-mark
of Union Carbide and Carbon Corporation*

NATIONAL CARBON COMPANY

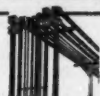
**A Division of Union Carbide and Carbon Corporation
30 East 42nd Street, New York 17, N. Y.**

*Sales Offices: Atlanta, Chicago, Dallas, Kansas City,
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**Pumps —
Catalog Section
S-7250**



**Pipe and Fittings —
Catalog Section
S-7000**



**Heat Exchangers —
Catalog Sections
S-6740 and S-6840**



**Cascade Coolers —
Catalog Section
S-6820**



**HCl Absorbers —
Catalog Section
S-7400**

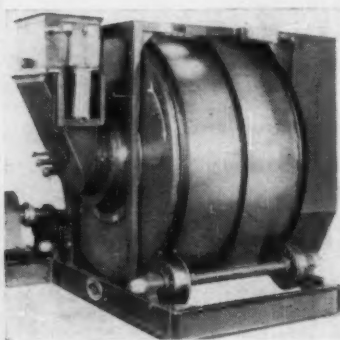
NEW PROCESSING EQUIPMENT

Porous-Metal Filters

Drop to price competitive with replaceable types.

Filters with permanent, porous-stainless-steel media have dropped in price 30 to 50 percent. Sparked by technological advances and increased sales volume this price realignment is said to make these filters directly competitive with "throw-away" types.

New price schedule will cover stock Surfamax filters including: (1) Porous media grades for removal of particles larger than 55, 22, 12, 7, 3, or 2 microns in size; (2) Filter areas up to 4 sq. ft. in stock sizes, and up to 10 sq. ft. in other standard models; (3) Flow capacities up to 50 gpm. of water or oil and up to 400 cfm. of air; (4) Connections for service on 1/4 to 2 in. pipelines. — Micro Metallic Corp., 30 Sea Cliff Ave., Glen Cove, N. Y. 248A

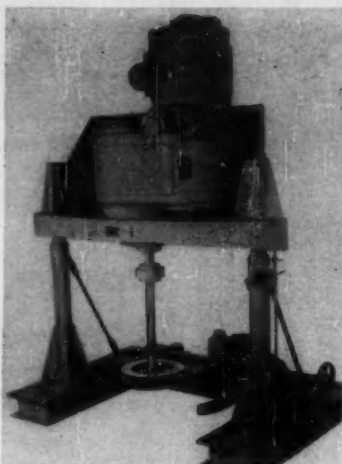


Dry Blender

Rotary type for dry or semi-wet materials.

Featuring a sealed mixing unit with a self take-up seal on the inlet a new rotary mixer blends dry or semi-wet materials. Mixer flights of special alloy-steel plate are arranged to blend materials completely in minimum time. Ample clean-out doors provide easy accessibility for quick, thorough cleaning.

Mixer is available in 37, 59 and 69 cu. ft. mixing capacities. Mixing capacities are based on 1/3 of total volume. — Davidson-Kennedy Co., 1090 Jefferson St., N. W., Atlanta, Ga. 248B



Change-Can Mixer

Disperses and mixes rapidly at viscosities up to 40,000 cps.

Inks, paints and chemicals can be mixed and dispersed in portable cans or tubs by using the new Stevenson change-can mixer. Cans sitting on the floor, pallets or dollies are all handled with equal ease.

Designed to operate on mixture viscosities ranging up to 40,000 cps. the mixer is built in sizes from 5 to 15 hp. It has a 15-in. shrouded impeller and will accommodate can diameters up to 42 in. Mixer speed can be varied from 320 to 640 rpm.

The entire mixing mechanism is raised or lowered electrically by a gearhead motor. Tub clamps, lined with brake lining, are operated by small hand wheel near the base of the unit.—The Stevenson Co., 228 North Wilkinson St., Dayton, Ohio. 248C

Water Conditioner

Prevents and removes scale formation by electromagnetism.

Now available in the United States is the Capi device for treating liquids to prevent scale formation. Already used in many parts of the world it is said to knock down scale-forming salts as fine powder that will not form scale. Old scale deposits become porous breaking away from the metal.

The Capi conditioner is a cylindrical chamber containing a series of very strong concentrically-mounted cylindrical permanent magnets. Liquid flows through the annular space between the magnets and the chamber wall.

Magnets are mounted with like poles together i.e. north to north and south to south. The magnetic fields act on the dissolved solids precipitating them as fine solids that will not adhere to heat transfer surfaces.

Capi conditioners are built with capacities ranging from 4 to 15,850 gpm. Among the applications are treatment of boiler feed water, cooling tower water, sea water, sugar juices, sulfite pulping liquor (investigated by an American university studying tube scaling), and milk.—Capi-American, Inc., P. O. Box 146, Columbus, Tex. 248D

Extraction Plant

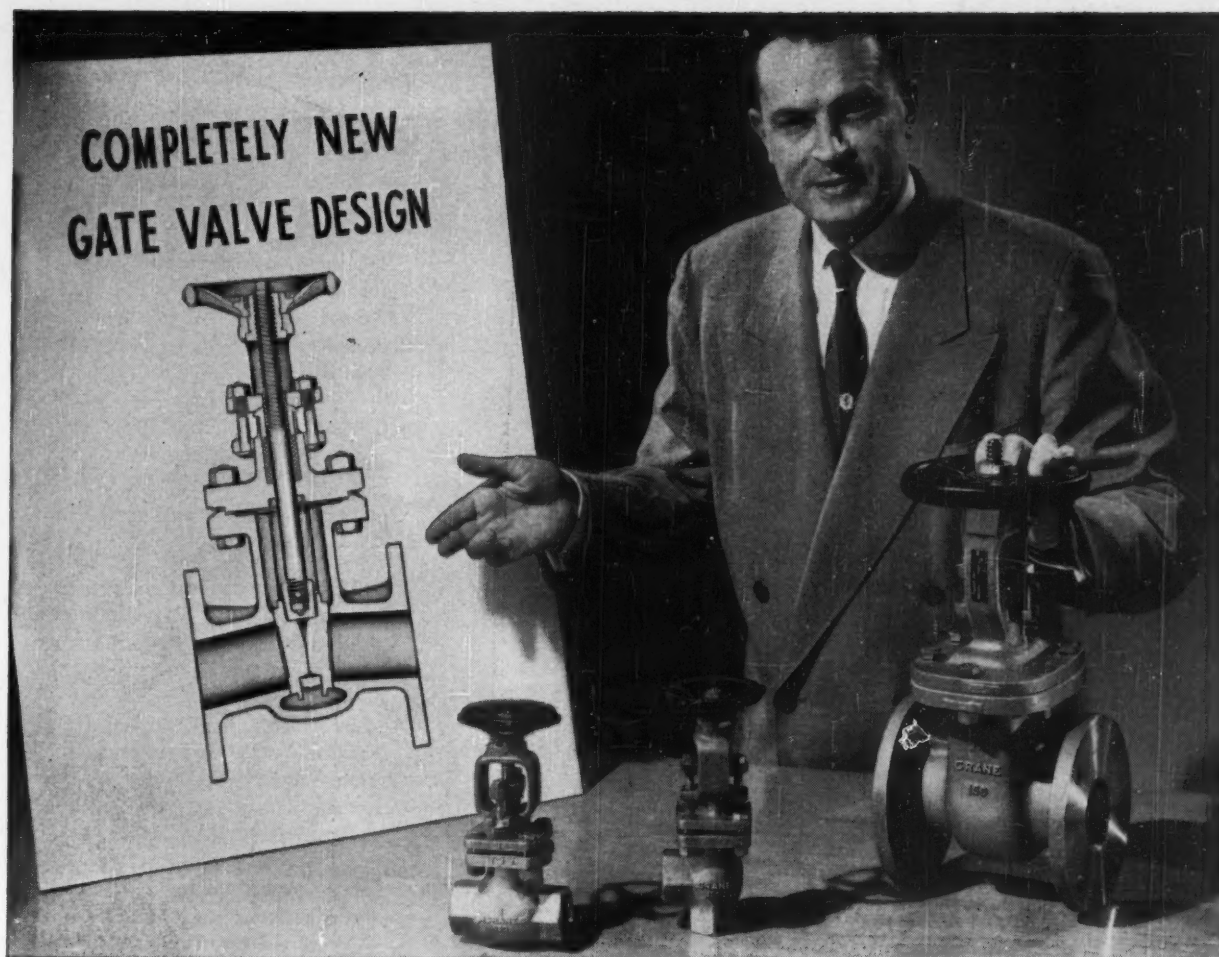
For oil-bearing materials offered as simplified, low-cost unit.

A highly flexible extraction plant for processing many oil-bearing materials now is available for simpli-

Equipment Cost Indexes

	Sept. 1954	Dec. 1954
Industry		
Avg. of all.....	184.5	184.2
Process Industries		
Cement mfg.	177.3	177.1
Chemical	185.9	185.7
Clay products	172.1	171.9
Glass mfg.	175.7	175.5
Paint mfg.	179.0	178.8
Paper mfg.	179.3	179.1
Petroleum ind.	182.5	182.3
Rubber ind.	184.9	184.7
Process ind. avg. .	183.0	182.8
Related Industries		
Elec. power equip. .	187.7	187.5
Mining, milling ...	186.8	186.6
Refrigerating	204.5	204.1
Steam power	175.2	175.0

Compiled quarterly by Marshall and Stevens, Inc. of Ill., Chicago, for 47 different industries. See *Chem. Eng.*, Nov. 1947, pp. 124-6 for method of obtaining index numbers; March 1955, pp. 178-9 for annual averages since 1913.



New CRANE Corrosion-Resistant Valves in 18-8 SMO and Craneloy 20

Gate, Globe and Angle Patterns

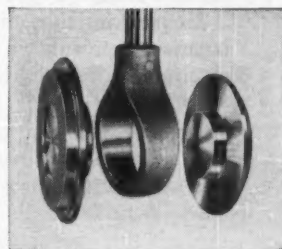
Few valves for process industries have ever received the quality treatment given this new Crane line.

Note, for instance, the unique yet simple split-wedge disc construction in the gate valves. Those dual identical discs are free to rotate in their holder—the most effective design for resisting galling. The trunion shape at the back of each disc assures even distribution of closing forces. You couldn't buckle them if you tried.

The globe and angle valves give equally

outstanding control of corrosive fluids. A new type disc-stem connection, with minimum clearances, practically eliminates vibration. By placing seating load closer to seats, it provides easier, more accurate closure.

Throughout, these valves are built for better service in your choice of Crane 18-8 SMO Stainless Steel or Craneloy 20. Both lines come with screwed or flanged ends. Full information given in circular AD 2059—available from your Crane Representative or on request to address below.



New split-wedge disc in gate valves combines the benefits of free rotation with uniform seat load pressure.

CRANE CO.

General Offices: 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas



VALVES • FITTINGS • PIPE • PLUMBING • HEATING

CRANE'S FIRST CENTURY . . . 1855-1955

NEW PROCESSING EQUIPMENT . . .

fied, low-cost installation. Integrated units of 40-ton capacity can be added and combined as needed to meet growing production.

Maintenance and upkeep costs for this plant are claimed much lower than for other extraction-plant designs. All moving parts are quickly and easily accessible from the outside, eliminating need for entering vapor-laden tanks, chambers and boxes. The extractor section is completely self-cleaning.

All waste water from the extraction system is reboiled to remove all traces of solvent before it is discarded. Combined with a continuous scrubber this design feature holds solvent losses to a minimum. —Crown Iron Works Co., 1229 Tyler St., N. E., Minneapolis 13, Minn. 248E

Chlorinator

High capacity model in corrosion-proof cabinet.

An improved high-capacity solution-feed-type chlorinator is built with a corrosion-proof polymer-impregnated fibrous-glass cabinet that never needs painting. Although designed for municipal water-works service this type unit is finding industrial applications controlling algae and treating waste streams.

Six metering tube and float combinations provide a range of chlorine gas feeding from 100 to 8,000 lb. per day.

Rate of chlorine gas injection can be controlled manually by a rate valve on the front of the cabinet. Actual flow is observed through the glass flow-meter tube.

In addition to manual flow-rate adjustment, the chlorinator can be furnished with a number of automatic functions. —Fischer & Porter Co., Hatboro, Pa. 250A

For More Information . . .



about any item in this department, circle its code number on the Reader Service

Postcard inside the back cover.



Centrifugal Nozzle

Improves performance of separator, reduces servicing time.

New nozzle design on Merco centrifugal separators improves slurry discharge flow and cuts replacement time.

Built either with flush-head or extended-head design, nozzle has flow passages that improve flow efficiency. It is recessed in the rotor bowl to allow free discharge of the jet at a fixed angle. Conventional O-ring seals the nozzle in the port, eliminating need for internal positioning or cementing.

Nozzles are removed easily using two screw drivers for the flush head or a drift pin for the extended head. —Merco Centrifugal Co., 150 Green St., San Francisco 11, Calif. 250B

Polyethylene Vessels

Now can be fabricated to withstand high temperature.

Process vessels constructed of polyethylene now are being built to withstand temperatures up to 350 F. without softening or distortion of the structure. At present, size is limited to 30 gal. or less but development now under way indicates larger structures will be built in the future.

Heat resistance is achieved by irradiating the formed vessel with the high-energy discharge from a Van De Graaff electrostatic generator. Cross links form between

molecular chains in a manner similar to the vulcanization process for rubber.

Not only is heat resistance improved but tensile strength and elongation are increased at room temperature. Solvent resistance is improved only slightly. The vessels are not subject to stress cracking. —American Agile Corp., 5461 Dunham Rd., Maple Heights, Ohio. 250C

Homogenizer

Disperses emulsions with ultrasonic waves.

Ultrafine dispersions with outstanding stability are produced by the Rapisonic homogenizer. Use of emulsifying agents is reduced or eliminated completely.

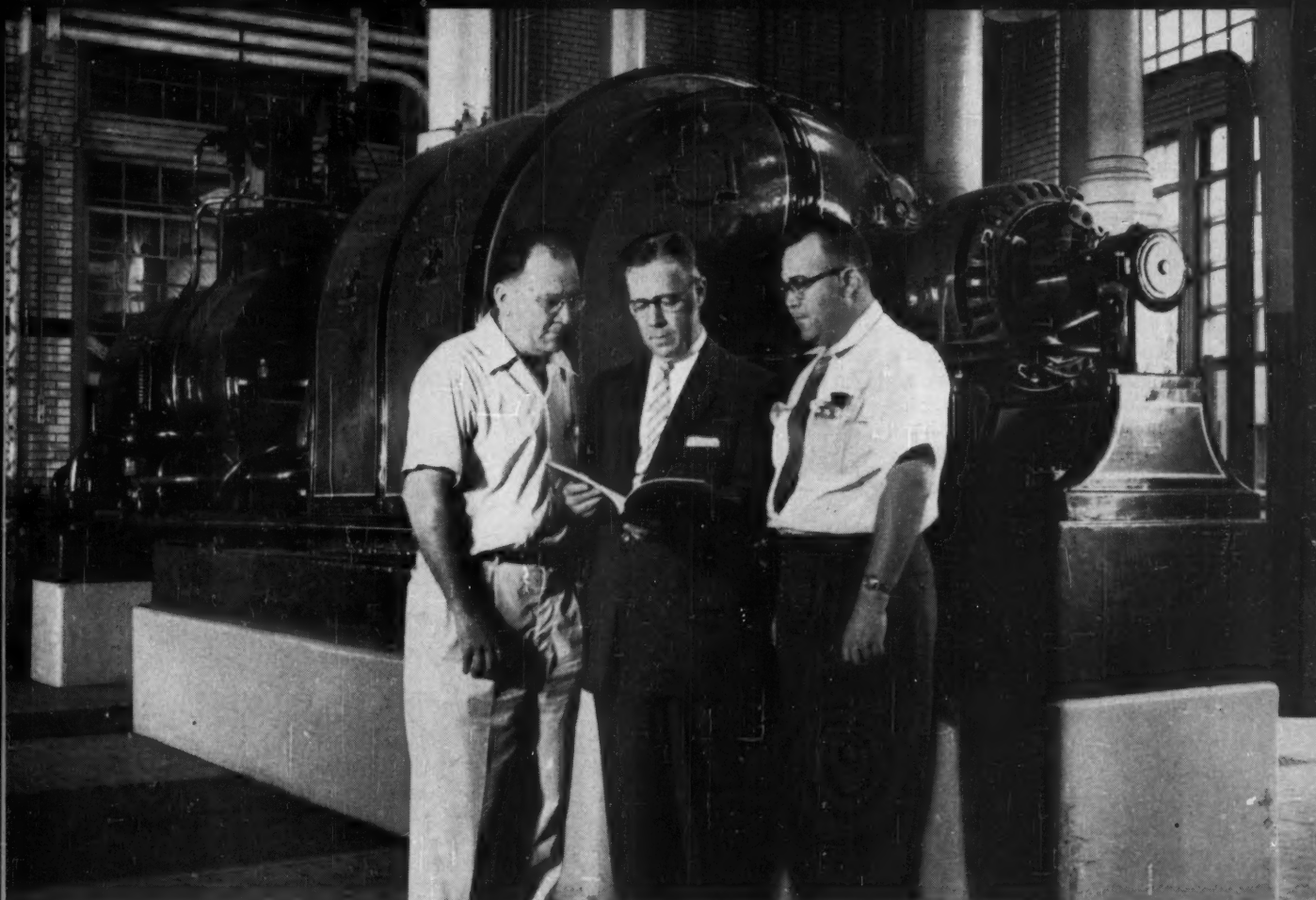
By using ultrasonic waves the Rapisonic unit can homogenize from 300 to 420 gal. per hr. with low consumption of power. It works well on wax emulsions, insecticides, dyes, photographic emulsions, resins, paper coatings, detergents and adhesives.

Material discharges at 30,000 psi. from a nozzle into a resonant bell where it impinges on a small blade. The impact of the liquid stream makes the blade vibrate at its natural frequency of approximately 22,000 cycles per sec.

The high frequency vibration produces continuous cavitation and violent molecular acceleration. Countless minute explosions disperse the particles into a finely homogenized emulsion that is highly stable.

The shape of the resonant bell concentrates and disperses the vibrations equally throughout the medium. Also, it maintains jet velocity whether the vibrating element is submerged or above the liquid level in the vessel.

A gear pump driven by a 2 hp. motor circulates liquid through the homogenizing unit. In operation the homogenizer can be set up to recirculate within one container or to transfer emulsified material to another vessel. —J. H. Day Co., Inc., Dept. 15, Cincinnati, Ohio. 250D



E. A. Hamann (left), Power Generation Engineer and Robert Best (right), Superintendent of Utilities, go over lubrication records with Bill Schall, Standard Oil lubrication specialist. Bill Schall has been providing technical sales service to Standard Oil customers since 1943. Bill is an engineer with a B.S. in engineering from Georgia Tech., and a graduate of Standard's Sales Engineering School. Customers of Bill's find this experience and background pay off for them.

Anheuser-Busch still using same turbine oil after 24 years

...NONPAREIL

For more than 24 years the Anheuser Busch Brewery, St. Louis, Mo., has been operating two 3,000 kw., turbines using NONPAREIL Turbine Oil. Three more turbines added to the system in 1940, '48 and '51 have also used NONPAREIL since beginning operations. The reason for choosing NONPAREIL is clear; it is guaranteed for the life of the turbine.

Since the initial installation, Anheuser Busch has not had to replace a NONPAREIL Turbine Oil fill. Neutralization number is always far below 0.15 mg. KOH/g., the degree of acidity Standard Oil guarantees NONPAREIL

will not exceed. At nearly all times neutralization number is on the order of 0.03 mg. KOH/g. (See chart).

In all these years, oil systems have remained clean. There has been no problem of oil acidity in any of the five turbines. The delicate art of brewing world famous Budweiser goes on without concern over power failure due to lubrication failure.

Like to know more about NONPAREIL and its possible use in your turbines? In the midwest call your nearby Standard Oil lubrication specialist. Or, contact Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

Anheuser-Busch Turbine Lubrication Record

Generator Capacity	Start up and NONPAREIL Installation Date	Date of Last Oil Analysis	Neutralization Number
3,000 kw.	Oct. 2, 1930	July 20, 1954	0.03
3,000 kw.	Oct. 2, 1930	July 22, 1954	0.02
2,500 kw.	June 10, 1940	July 20, 1954	0.03
7,500 kw.	Jan. 2, 1948	July 22, 1954	0.03
7,500 kw.	July 26, 1951	July 22, 1954	0.01



STANDARD OIL COMPANY
(Indiana)

NEW HEATING & COOLING EQUIPMENT

Packaged Boiler

Uses internally-finned tubes to increase capacity, boost efficiency.

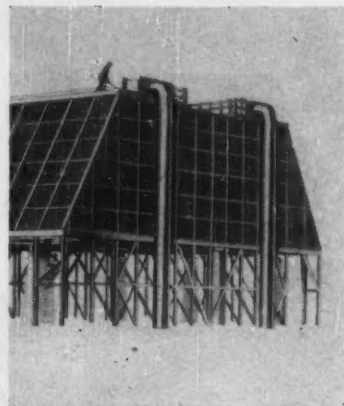
Backed by seven years of field testing the new Fintube boiler claims to produce more steam and require less space than earlier designs. Compared to a 100 hp. bare-tube boiler a Fintube unit of equal rating is only about $\frac{2}{3}$ as wide; $\frac{2}{3}$ as long; and $\frac{2}{3}$ as high.

The internally-finned tubes have

a fire-side to water-side ratio of about 3 to 1; similar ratio for plain bare tubes is only 1 to 1.1. In addition to the increased area the internal finning increases the turbulence of the hot gases thereby improving heat transfer. Together these features allow optimum heat pickup with only one short pass through the tube section of the boiler.

Built in standard 30, 60 and 100 hp. sizes Fintube boilers are AGA approved for all gaseous fuels and

have been thoroughly tested on liquid fuels.—Brown Fintube Co., Elyria, Ohio. 252A



Cooling Tower

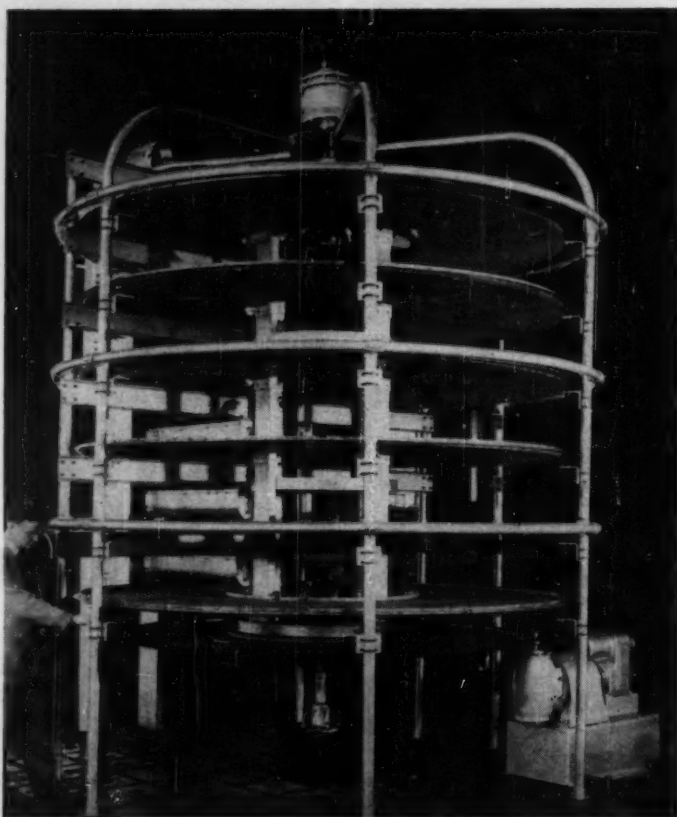
Gains efficiency by controlling recirculation of air to move moisture away from tower.

In the Wind-trol cooling tower, better efficiency, reduced maintenance and longer life have been gained by rearranging standard tower parts.

Wind and the tower structure are claimed to be properly balanced for all conditions so that recirculation of air is eliminated. Unsaturated air can pass freely under the tower, supplying the forced draft fans on both sides. There is always excess unsaturated air discharging from the leeward side to prevent backward movement of saturated air discharging from the tower.

Tower is mounted on an open substructure and is supported, along with the redwood basin, on "cast-in-place" concrete piles. Fans are mounted individually either on steel pipe columns or small concrete structures resting on the ground. They are not part of the main tower structure, thus do not vibrate structure.

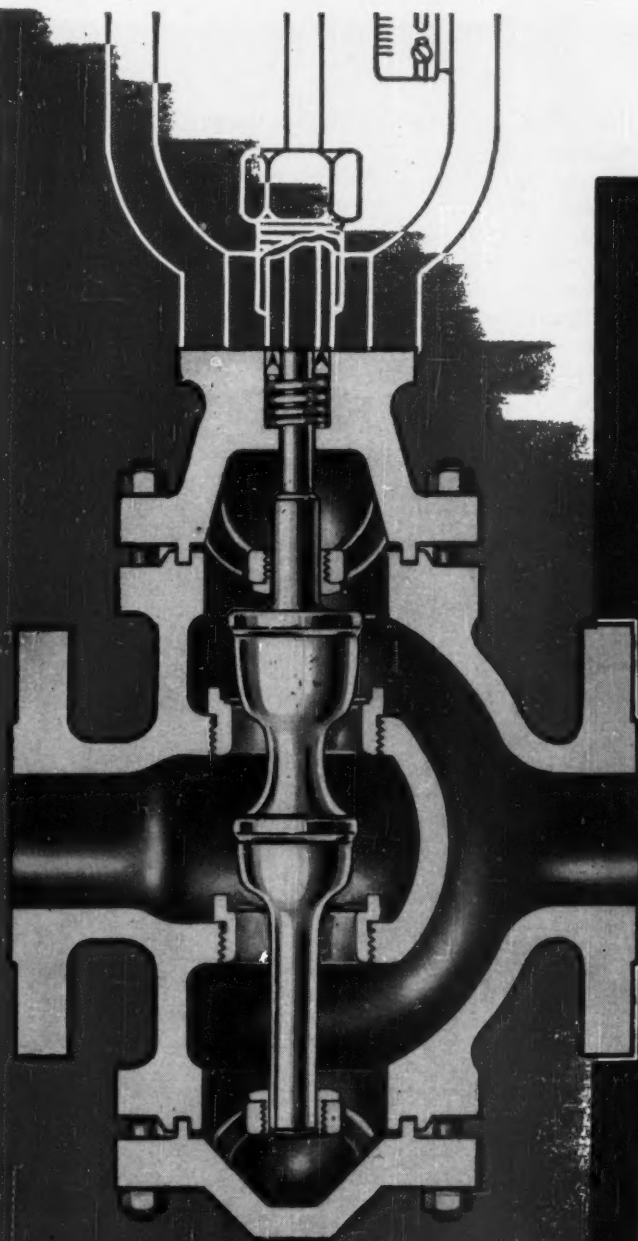
Other features include a watertight redwood basin protected with a special water-proof membrane, relative freeness from fungus attack and ability to use horizontal pumps.—Santa Fe Tank & Tower Co., Inc., 5401 South Boyle Ave., Los Angeles 58, Calif. 252C



Sulfur Cooler Stacked Up to Save Space

This Roto-Shelf cooler with six 10-ft. diameter trays mounted on a vertical shaft occupies a space only 16 ft. square by 12 ft. high. With each tray operating as a separate cooler it continuously cools and solidifies sulfur, pitch and similar materials. Cooling water flows through the baffled interior of each

shelf, assuring uniform cooling with minimum water consumption. A stationary ramp lifts material from the rotating tray into breakers that discharge into screw conveyors feeding a common take-away conveyor.—Buflovak Equipment Div., Blaw-Knox Co., Farmers Bank Bldg., Pittsburgh, Pa. 252B



Insures superior control with tighter shut-off on high temperature service.

Both upper and lower seating surfaces contact simultaneously at specified operating temperatures.

FISHER®

**IS THE VALVE
MANUFACTURER
THAT LAPS THE
SEATS OF
DOUBLE PORTED
VALVE BODIES
AT OPERATING
TEMPERATURES**



Fisher valve being steam heated to specified operating temperature.



Inner valve being "ground in" while assembly is hot.

FISHER GOVERNOR COMPANY • MARSHALLTOWN, IOWA
WORLD LEADER IN RESEARCH FOR BETTER PRESSURE AND LIQUID LEVEL CONTROL

FISHER

Our 75th
ANNIVERSARY

NEW INSTRUMENTS & CONTROLS



Pneumatic Receiver

Standardizes multiple recording.

From one to four identical units of a new pneumatic receiver can be mounted in the manufacturer's receiver-recorder. Unit receives pneumatic signals transmitted from a measured variable and drives a recording pen. Multiple installation is possible because of plug-in, pin-positioned construction and a unique, indexed drive arm.

Pre-calibrated and unitized design permits placing a new receiver in service within an hour. Receiver is factory calibrated to less than $\pm \frac{1}{2}\%$ of range span, is sensitive to signal changes of 0.01 psi.

Ambient temperature changes between 30 and 130 F. are compensated automatically by an isoelectric spring. Hysteresis error is negligible.—Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland 10, Ohio 254A

Facilities Control

Automatically controls electrically-operated services.

A recently-introduced "electronic supervisor" follows preset programs and automatically switches on or off up to 40 groups of remote operations, each on its own time schedule. By utilizing service machinery only when it is needed savings are realized in fuel, water and electrical power. Equipment life is extended also.

The Central Control System can

switch lights on or off, start and stop motors, open and close valves, control air conditioning, and perform scores of other operations.

System uses carrier current signals and operates over existing electrical circuits. There is no need to install a single transmission wire.

Another feature is the use of central control panel. Remote, electrically-controlled services can be checked merely by glancing at the indicator lights on the panel.—International Business Machines Corp., 590 Madison Ave., New York 22, N. Y. 254B

Safety Regulator

Stops flow when temperature exceeds preset level.

For protection against over-temperature conditions the Stacon VS safety regulator instantaneously stops flow of gas or steam to heating elements when temperature reaches the set point.

Valve normally is held open by a latch until the thermostatic bulb temperature reaches a predetermined set point. Instantaneous liquid expansion of the bellows trips the latch and a spring closes the valve. Valve is snap-acting and remains closed until manually reset by depressing a knob located on the valve top works.

Type VS is available in sizes from $\frac{1}{4}$ to $1\frac{1}{2}$ in. It will control temperatures between 25 and 325 F. with a 50° F. range of adjustment.

Inlet pressure limit is 100 psig. Bodies are bronze with replaceable stainless steel seats and disks.—Farris Stacon Corp., Palisades Park, N. J. 254C

Load Elements

Measure tension, compression or force.

Just announced is a series of re-designed and highly sensitive volumetric load-measuring elements for a wide range of applications. Measuring tension, compression or force, the elements average 99% accuracy, are not affected by hysteresis or

friction in the loading system.

Four types of elements are provided: spool, ring, diaphragm and capsular.

Spools for compression loads up to 250,000 lb. and tension loads up to 30,000 lb. are used for constant checking of tankcars, etc. Rings, good for compression loads only up to 25,000 lb., are used on pulp beaters and similar jobs.

Diaphragm elements measure squeeze roll pressure up to 6,250 lb. And the capsular element measures film tension within close limits as an indication of stretch. It has a range up to 300 lb. and is adjustable to a minimum span of 30 lb.—Taylor Instrument Co., Rochester 1, N. Y. 254D

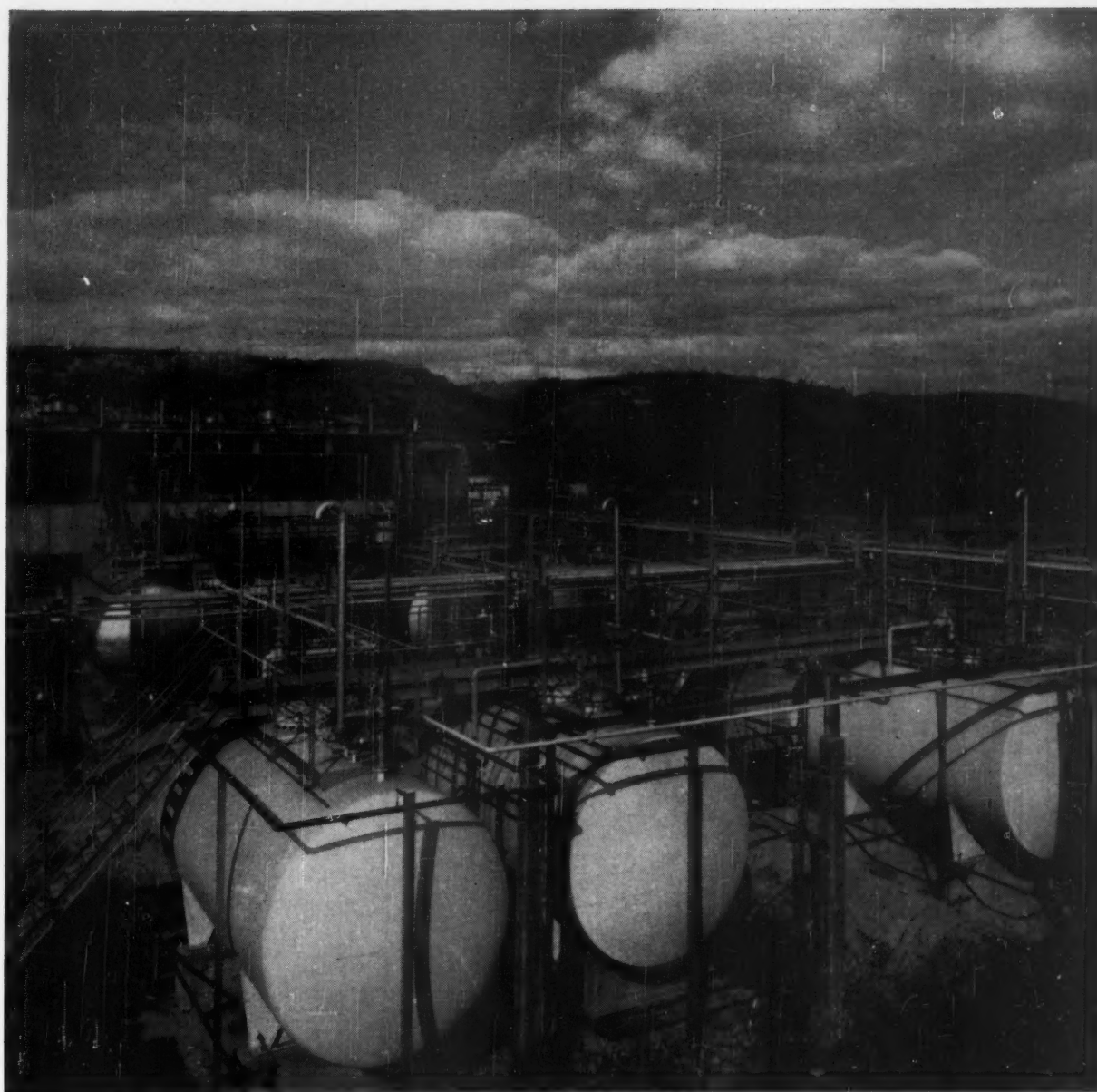


Toggle Valve

Seats tightly on high pressure or vacuum service.

Designed for direct panel mounting without modification, a quick-acting toggle valve operates up to 1,000 psi. or on high vacuum. A hardened steel cam holds leakage during opening and closing on vacuum to less than 0.01 micron liter per cycle. An adjustable cap nut allows the seat to close tightly when the operating lever is at right angles to the stem.

Valve bodies are machined from bar stock. Valve seats are a semi-hard, plastic, corrosion-resistant material. Brass valves have O-ring seals; stainless steel are fitted with either O-rings or Teflon chevron packing.—Hoke, Inc., 139 South Dean St., Englewood, N. J. 254E



For any kind of chemical construction . . .
you can count on KOPPERS!

In the chemical industry, only in rare instances do the results of research justify the immediate construction of a full-scale chemical plant. Therefore, Koppers builds development plants as well as large chemical plants.

A case in point is this development plant at Kobuta, Pennsylvania — designed and constructed by our engineering staff. Here, experimental plastics developed by research are adapted to commercial use, and are produced in semi-commercial quantities for sampling and use by customers. This plant is designed in such a

way that it can be expanded as the need arises.

Our Engineering and Construction Division can handle your smallest or largest construction jobs. Whether you are interested in producing test-tube or tank-car quantities of chemicals, just call on Koppers. Your inquiry is invited.



KOPPERS COMPANY, INC.

Engineering and Construction Division
 Chemical Department
 Pittsburgh 19, Pennsylvania

NEW SAFETY EQUIPMENT

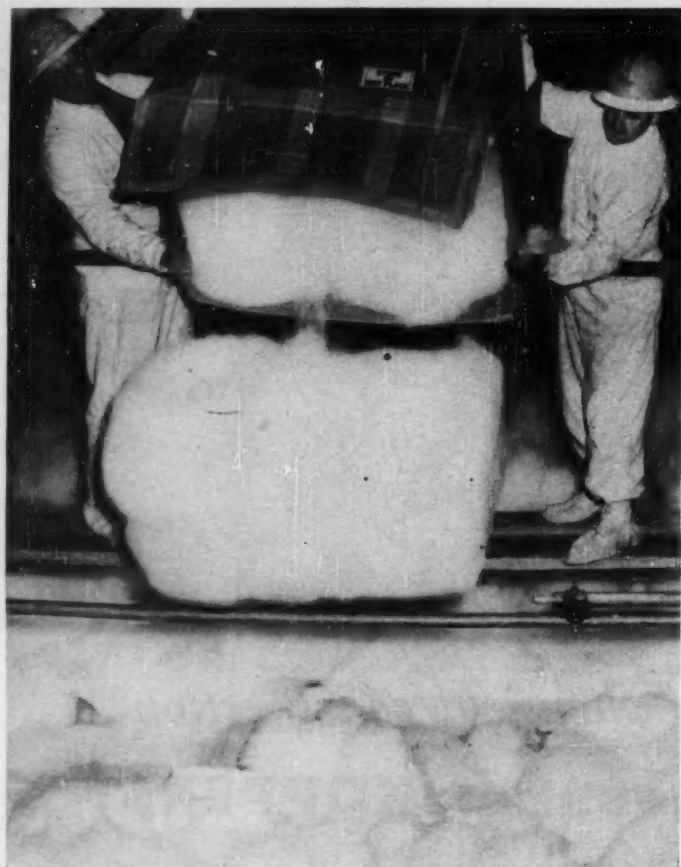
Protective Hood

Protects fire fighter against radiant heat up to 2,500 F.

A new lightweight protective hood has been introduced recently to protect firefighters from radiant heat temperatures as high as 2,500 F. It's made of Fyre-Armor, the recently developed heat- and flame resistant fabric of various metallic layers with an outside coating of aluminum foil.

Hood has eyeglasses highly resistant to heat and complete freedom of movement. It is sufficiently spacious so that firefighter can wear standard breathing equipment or a smoke mask, and a standard skull guard.

Other equipment incorporating Fyre-Armor includes fire-fighting suits, rescue blankets, industrial aprons, mittens, leggings and boots. —Far-Ex Corp., 75 West St., New York, N. Y. 256A



Glass Fiber Fallout to Check Radioactive Gas.

Workers at the Hanford Atomic Products Operation install a new fibrous glass filter to purge exhaust gases of radioactive particles. Bed of glass fibers is 7 ft. deep and 56 ft. long. G. E., operating the facil-

ity for the Atomic Energy Commission, finds this type filter more efficient and less costly than sand filters employed formerly for this job. General Electric Co., Schenectady 5, N. Y. 256B

For More Information...



about any item in this department, circle its code number on the Reader Service

Postcard inside the back cover.

Emergency Oxygen

In portable, compact unit saves time when life is at stake.

In an emergency, the lightweight Pocketaire oxygen unit can be transported easily to the point of need. Any untrained person can administer oxygen, or the unit can be used for resuscitation by anyone trained to give normal manual respiration for saving life.

Although new the Pocketaire already has proved its value by saving lives from smoke inhalation, drug and gas poisoning, burns, heart attacks, shock, heat exhaustion and cardiac asthma.

Complete unit in a carrying case includes two lightweight standard "B" medical oxygen cylinders, a flow regulator with gage for flow rates of 3 to 7 liters of oxygen per min., and two disposable masks. Over-all weight is 17 lb.—Cycle-Flo Co., Milford, Conn. 256C

Chemical Goggle

Used near splashing liquids or in dusty air.

Perfectly contoured and molded from soft, flexible synthetic rubber the new No. 100 chemical goggle fits snugly and comfortably, protects eyes completely. It is large enough to be worn over most eyeglasses.

Worker has full vision through the wide, transparent plastic window. Baffled ventilator holes on each side allow air to circulate and prevent fogging. Window can be removed from soft rubber frame and replaced within seconds, if necessary.—Chicago Eye Shield Co., 2300 West Warren Blvd., Chicago, Ill. 256D

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TREMENDOUS SAVING OF REVERSAL TIME

(Only 7 Minutes Required)

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- Body Stays in the Line

CONSOLIDATION OF SPARE PARTS

- Direct and Reverse Topworks Identical
- Plugs Pinned to Seat Upward or Downward as Required

HAMMEL-DAHL COMPANY

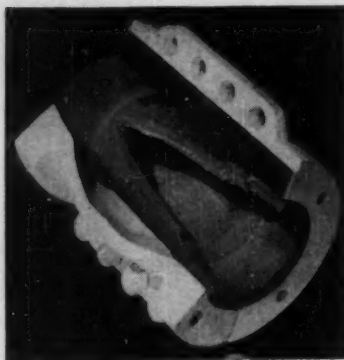
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CANADIAN MANUFACTURING AFFILIATE—GUELPH ENGINEERING CO., GUELPH, ONT.

NEW FLUIDS HANDLING EQUIPMENT



Slurry Valve

Throttles flow by compression of flexible liner.

Slurry flowing in pipelines can be controlled smoothly by the new Red Jacket sleeve valve. A flexible sleeve within a rigid metal body is compressed by externally-applied air or hydraulic pressure to throttle the flow as desired.

Designed primarily for severe service handling suspended solids the new valve also can control common fluids such as water, gas and oil. Features include simple construction, good throttling control for on-off service, ability to function as a pressure-reducing valve and excellent flow characteristics for instrument control.

Valve body is cast iron; the sleeve is pure gum rubber, butyl or neoprene. Throttling impulse can be applied directly from instrument or solenoid.—Red Jacket Co., Inc., Investment Bldg., Pittsburgh 22, Pa. 258A

Air Filter

Gains high efficiency through permanent, self-charging electrostatic action.

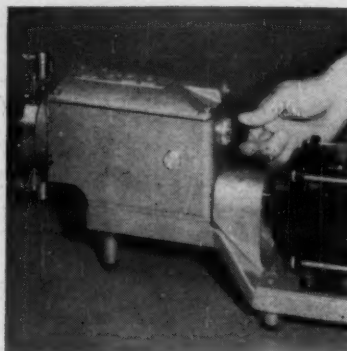
Voltage of natural electrostatic charges on Dacron polyester fiber is increased by the friction of air passing through a mat of the fibers. That's the secret of Electra air cleaner's high efficiency.

Both positive and negative charges are present in close proximity on the Dacron fibers. Since air passing through boosts the voltage level, trapping action improves.

The polyester media is coarse and resilient to withstand impact and abrasion from large particles, yet is free of large openings that would pass air-borne particles. Therefore, the Electra air cleaner traps both by impingement and electrostatic attraction.

Media can be cleaned merely by immersing in water or holding it under a stream of water. No high pressure is needed. Cleaned element is drained and put back into service. To remove grease or oil a detergent can be used.

Capacities of individual units run up to 2,080 cfm.—Extr-Aer Co., 1210 Chenevert, Houston, Tex. 258B



Low-Rate Feeder

Based on well-proven design; handles micro flow rates.

The new Microflo Pulsafeeder pumps, meters, feeds and proportions fluids precisely at micro flow rates. It will work against pressures up to 1,000 psig. delivering a maximum flow rate of 2,400 ml. per hr.

Piston-diaphragm pump has no stuffing box, packing or running seal in contact with the liquid being pumped. A hydraulically-balanced diaphragm isolates the product from all pumping parts.

Microflo unit is driven directly by a 1/20 hp. motor. Pumping rate is controlled by varying the length of the piston stroke through a manually-operated dial indicator. Rate can be adjusted from 0 to 100% capacity either while the pump is idle or operating.—Lapp Insulator Co., Inc., Process Equipment Div., 7 Gilbert St., LeRoy, N. Y. 258C

Proportioning Pump

Fitted with plastic liquid ends to resist corrosion.

With the type U proportioning pump you can handle corrosive materials such as ferric chloride, sodium hypochlorite, cupric chloride, and hydrochloric, hydrofluoric and nitric acids.

Pump body and check valve assemblies are fabricated from either unplasticized polyvinyl chloride or Kel-F. Pump plungers and check-valve balls are made of ceramic.

The plastic components are completely interchangeable with metallic liquid ends; you can convert existing metal U pumps to plastic construction.

Pumps can deliver up to 19 gph. per feed and are built in one, two, three and four-feed units.—Hills-McCanna Co., Pump Div., 3025 North Western Ave., Chicago 18 Ill. 258D

Air Filter

Offers choice of three different dust collecting efficiencies.

Special glass-fiber mats and a deep-pleated design permit the Aerosolve filter to operate with high efficiency and low pressure drop. And there is a choice of three different filter cartridges to satisfy job needs, with efficiencies ranging from 30 to 95%.

Filter consists of a permanent cadmium-plated steel frame which contains the replaceable filter cartridge. Cartridge is supplied completely assembled in a fire-resistant, double-corrugated board frame.

Aerosolve filters have large dirt-holding capacity and long life. Since all dirt is collected inside the pocket formed by the Aerosolve filter cartridge, dirt does not spread through the downstream ductwork during replacement of the cartridge.

Filter measures 2 x 2 x 1 ft., has surface area of more than 40 sq. ft. By placing the frames in V formation duct velocities over 400 fpm. can be obtained.—Cambridge Filter Corp., 738 Erie Blvd. East, Syracuse 3, N. Y. 258E

How Reynolds Aluminum Serves the Chemical Industry

Light, strong, versatile aluminum pays off in dozens of processing applications

The metal requirements of the processing industries were made for aluminum. Here is a metal attractive in appearance, light but strong, non-rusting and resistant to corrosion. It has natural insulating qualities, great resistance to thermal shock, is non-sparking and non-magnetic. Shown here are just a few examples of aluminum at work in the chemical industry.

The staff of Reynolds regional offices includes chemical and other engineering specialists to help you save time, money and labor with aluminum chemicals, shipping containers and mill products. A fully integrated technical staff at Reynolds headquarters is available for further consultation. For information call your nearby Reynolds office listed under "Aluminum" in the classified telephone directory, or write *Reynolds Metals Company, 2567 South Third Street, Louisville 1, Kentucky.*

Moisture and corrosive contents find aluminum impervious. Maintenance costs are eliminated, replacements rare even in the presence of corrosive fluids.

Lower cost, longer life and high heat transfer are economical reasons for aluminum heat exchanger tubing in the process industries.

A whole family of basic aluminas for processing, ceramics, commercial chemical compounds, drying and reduction operations.

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ALUMINUM

**Modern Design
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ALUMINUM PAINT PROTECTS...

...against rust, smoke and fume corrosion, evaporation of volatiles, and heat expansion

Good aluminum paint actually puts a protective *shield* on rustable metal and masonry.

In the chemical industry this means needed protection against corrosive smoke and fumes, against rust, against concrete spalling. And because aluminum paint reflects up to 85% of light and heat rays, it reduces evaporation of volatiles, guards against heat expansion and brightens everything inside and out.

Use it everywhere—from rig to retail. A single coat usually covers and lasts for years. Watch it cut maintenance and replacement costs.

Reynolds Metals Company does not make aluminum paint. But if you would like the names of manufacturers who rely on the high quality of genuine Reynolds Aluminum Pigments, we'll gladly send you the list. Just use the coupon below.



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Asphalt-Aluminum Roof Coatings and Paints add years to roof life, keep interiors cooler in hot weather. Insist on aluminum roof coatings bearing this warranty. It assures you of an approved vehicle and at least two full pounds of highest quality aluminum metal pigment in every gallon.

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Relamp or Convert to Higher Wattages in SECONDS...

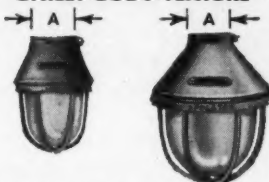
with
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vented
Explosion-Proof
Fixtures



Patent
Applied For



APPLETON INTERCHANGEABLE UNILET BODY FEATURE

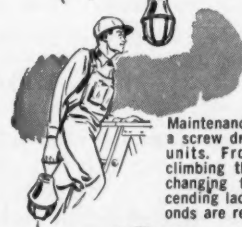


Note how identical diameters "A" at top of Dome Unit Assembly permit mounting of all fixtures regardless of wattage.

58 SECOND RELAMPING



When the call comes for re-lamping, AA-51 Series STAND-BY Units are ready at an instant's notice. Carrying handles can be attached in advance.



Maintenance man needs only a screw driver to exchange units. From the time of climbing the ladder to exchanging fixture and descending ladder, only 58 seconds are required.



Burned out lamps and cleaning fixture are safely attended to at the work bench, while production schedules are maintained.

Standardized Unilet Body Permits 58 Second Interchange of 60 Watt to 500 Watt Fixtures . . . Saves Time, Prevents Shutdowns! Appleton AA-51 Series Vented Explosion-Proof Fixtures offer the most complete spark-caused disaster protection available today . . . plus the shortest possible lamp exchange time with no loss of man-hours and no lengthy machinery shutdowns.

The AA-51 Series meets all Underwriters' Laboratories requirements for Class I, Groups C and D Hazardous Locations.

More and more plants in all industries where hazardous locations are present, are standardizing on *Appleton* for maximum, efficient protection.

Full details are available. Write Today for Bulletin!

• "FLAME-TIGHT" CONTACT CHAMBER

Because of *Appleton's* exclusive "5-Thread Safety Chamber" any AA-51 Series Unit can be serviced with complete safety even if current is inadvertently left on!

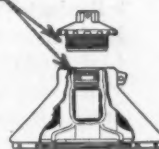
• "FULL-CIRCLE" VENTING

The notched globe ring and the porous metal interior dissipate heat evenly and safely and keep fixture temperature cool enough to prevent igniting explosive gases.

• "STAND-BY" SYSTEM SAVES MONEY

For every ten AA-51 Units in operation *Appleton* recommends one unit as a stand-by . . . ready for relamping or wattage conversion in 58 seconds.

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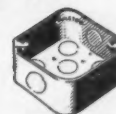
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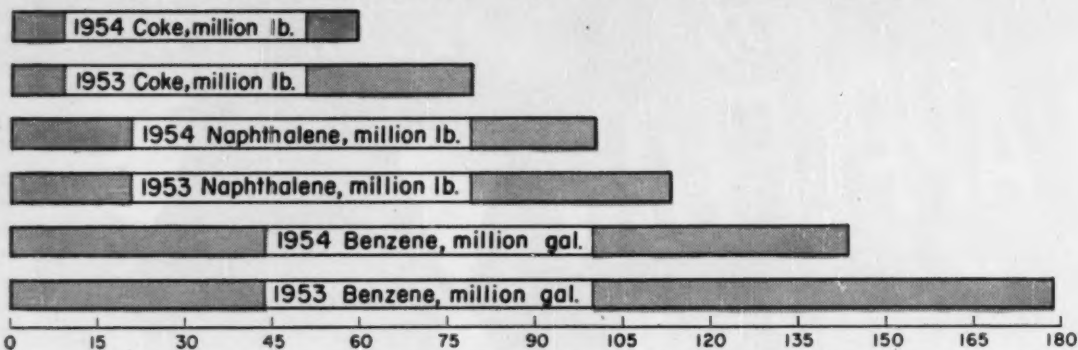


"ST" Series
Connectors



Outlet Boxes

In 1954, steel plummeted, coke and coal chemicals followed....



In 1955, Coal Chemicals Are Recovering

Steel's drop last year slashed coke demands. From slowed-down coke ovens came a slackening flow of chemicals. But for 1955—assurance of a rising market.

Calvin S. Cronan, Associate Editor

So closely wedded are steel production and output of coke and coal chemicals that they slumped side by side during 1954's recession. Steel ingots and castings fell off from 112 million tons in 1953 to an output rate of 88 million tons in '54—71% of capacity. Coke production dropped 25% to an 8-year low of 59.5 million tons.

► **Products Shift**—Although this hard fall in oven-coke output tumbled production of coal chemicals, yields increased at the lower operating rate for materials such as tar, ammonia and light oil.

Yield of crude tar, for instance, increased over the previous year from 7.9 to 8.46 gal. per ton of coal carbonized. Recovery of crude light oil was 2.93 gal. per ton, the highest since 1940. Ammonia yield, in terms of sulfate equivalent, advanced from 20.09 lb. per ton in 1953 to 21.2 lb. in 1954.

Production of light-oil derivatives, benzene and toluene, de-

creased 19% and 7% respectively; xylene may have increased slightly.

Output of crude naphthalene decreased less than most other coal chemicals. Reason was that several new tar-processing plants, primarily for naphthalene recovery, went on stream during the year. And with the new plants came a shift in grades of naphthalene produced.

In previous years 50-60% of total naphthalene output was very crude material, melting point below 74 C. In 1954 only 23% of the total was this crude product. Roughly $\frac{2}{3}$ of production was higher-quality naphthalene melting at 76-79 C.

Pyridine held the unenviable post of tail-end in the parade with a drop of 55% in output of the 2-deg. product.

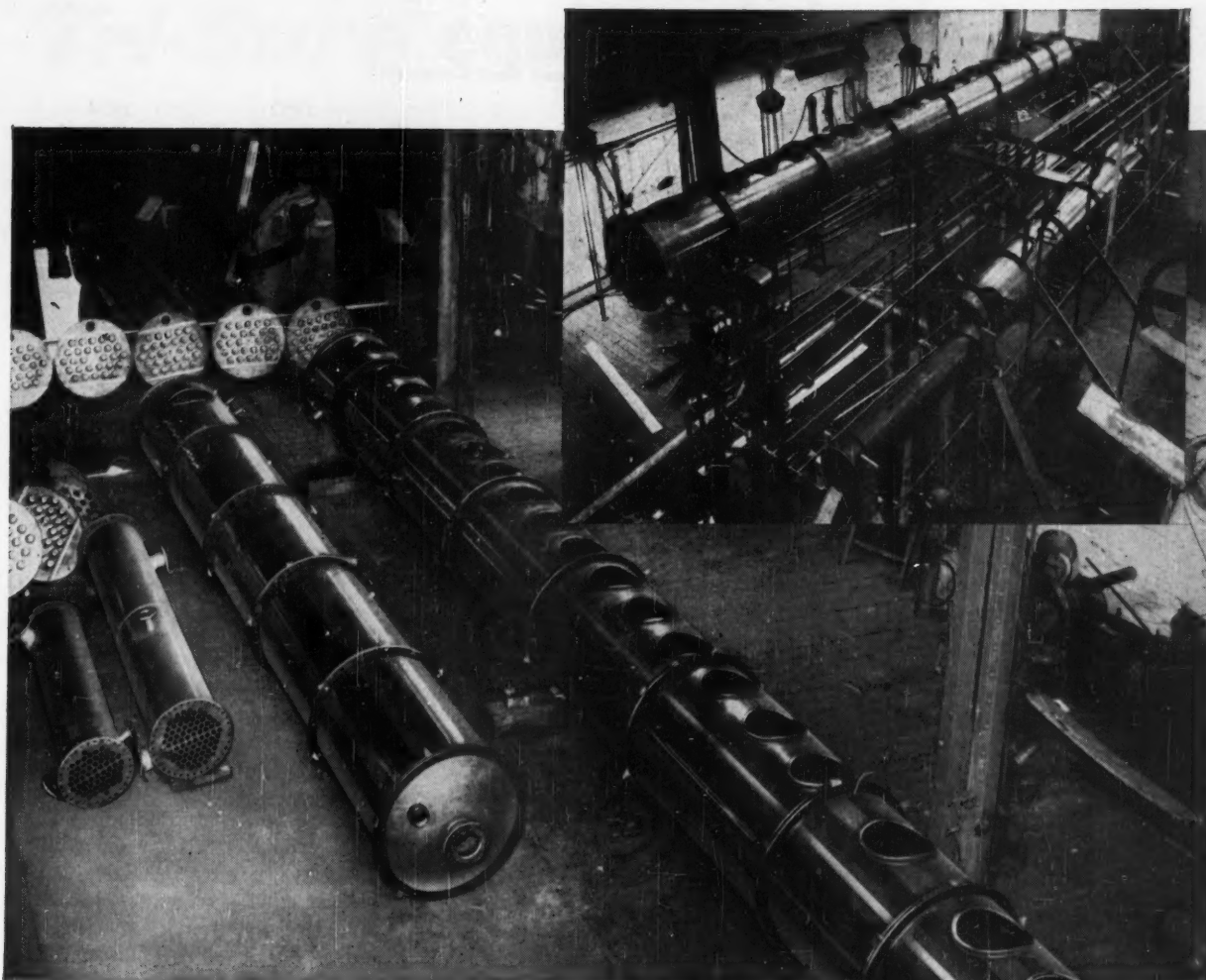
► **Market and Price**—In the market place, sales people feel they had a relatively good year. In general, prices of coal chemicals usually show good stability and 1954 was no exception.

Early in the year, prices were shaved in some cases and demand brightened slightly since inventories had been pared thin during waning 1953.

Naphthalene started the year $1\frac{1}{2}\%$ under quotations that prevailed during most of 1953. Phthalic anhydride went down as did domestic naphthalene. Shortly thereafter the price of imported naphthalene edged up due to a European market change. Increased output of European phthalic anhydride tied down naphthalene so that there was little surplus for the American market.

By year's end demand rose for phthalic anhydride from makers of alkyd resins and paints. With a firmer tone in phthalate plasticizers, this stimulated a rise in naphthalene prices to within $\frac{1}{4}\%$ of the 1952-53 level.

Benzene producer and consumer inventories were too high early in the year as cutbacks in the government rubber reserve program weakened demand. While consumption of benzene for styrene production was off for the same reason, some still kept moving to styrene for polystyrene resins. Demand from manufacturers of synthetic phenol



REVERE COPPER *ideal for distillation columns*

These photographs show three distillation columns fabricated by American Copper & Brass Works, Cincinnati 2, Ohio, for a customer in a foreign country. They are made of Revere Copper Sheets and Circles. All told, 4608 pounds of copper were required. The columns will be used to distill high-proof alcohol, either beverage or industrial.

Longitudinal seams were welded. Flanges were produced by simply turning the metal over to the required dimension. Copper, you see, is extremely easy to work. In addition, it does not react with alcohol and a wide variety of other liquids and gases. Copper also can be quickly and economically welded by modern methods, and if you wish, the Revere Technical Advisory Service will be glad to show you how to do a fast and sound welding job on copper sheet and plate. See the nearest Revere Sales Office.

Two views of three copper distillation columns by American Copper & Brass Works, Cincinnati. The large holes will be closed by removable plates, for inspection and cleaning.

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COPPER AND BRASS INCORPORATED

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ECONOMICS . . .

was not very high and benzene-derived insecticides moved slowly.

About 2.7 million gal. of excess benzene flowed into the motor-benzene market; other went to foreign markets. Later in the year the market tightened until rising steel production increased the flow. By the turn of the year price had dropped 4¢ a gal. to 36¢, due to incoming surges of low-cost imports.

Toluene prices held throughout the year despite reduction in nitration requirements early in the year from 70% to 50% of coal-tar production. Industrial demand absorbed the slack but the last quarter found some surplus on hand. Xylene demand held fairly good throughout the year.

Sales volume of phenol was reasonably good compared with past consumption. However, capacity increased during the year as a number of new phenol-from-cumene plants came on stream. During the first quarter, price slacked off 2¢ a lb. aimed at promoting greater call.

Tar acids held steady throughout the year. Tricresyl phosphate sopped up meta-para fractions with other demand stemming from engine cleaners. Prime outlet for cresols and cresylic acid is resins which were helped by the expanding automobile market.

Ammonium sulfate prices posted in October for the period through May 31, 1955 were \$42-47.50 per ton fob., a continuation of the level prevailing during the preceding six months. There appeared

Production of Coke and Coal Chemicals*

	1953 (Million Tons, Pounds or Gallons)	1954
Coke, tons.	78.8	59.5
Ammonium sulfate, lb.	1,893.0	1,646.0
Ammonia liquor, lb.	49.7	37.1
Crude coal tar, gal.	828.7	716.0
Creosote oil, gal.	37.3	33.0
Crude naphthalene, lb.	112.9	100.0
Benzene, gal.	178.7	143.7
Toluene, gal.	36.0	33.4
Xylene, gal.	9.9	9.9
Solvent naphtha, gal.	6.3	5.5
Refined pyridine, lb.	1.3	0.6

*Source: U. S. Bureau of Mines

a good chance that competition from other forms of fertilizer would keep the price from rising.

► **A Look Ahead**—Viewing the year ahead the American Coke and Coal Chemicals Institute forecasts coke-oven benzene production up from 141 million gal. in '54 to about 165 million gal. in '55. Production by tar distillers and redistillation of crude imports to chemical-grade benzene is expected to rise from an estimated 18 million gal. in '54 to 23 million this year.

Petroleum benzene probably will stay about the same. Increased coke-oven production will just about cover expected demand increases.

Total benzene consumption is predicted to climb from 248 to 263 million gal. Outlets contributing to this growth will be: phenol, up some 6-7% due to the general rise in use of plastics; styrene, up about 15% because of increased call from plastics and rubber in approximately equal amounts.

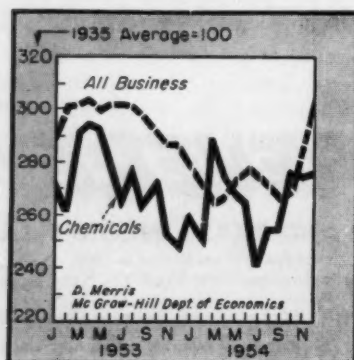
Estimated increased call from rubber is based on the feeling that industry, as the new owners of government's GR-S plants, will have to operate them to the fullest extent to minimize fixed costs. Even if natural rubber were selling cheaper than synthetic, which it isn't, synthetic would likely have preference in order to keep the plants operating.

Other benzene derivatives: aniline use will be up some 15%; DDT and BHC will stay about the same.

Production of toluene from coke ovens dropped from 36 million gal. in '53 to 33 million gal. in '54. An upswing in '55 is expected to carry it back to 35 million gal. Production of toluene from petroleum and other sources was about 107 million gal in '54 and should be about the same in '55 since demand will be about constant.

Xylene output during '54 held level with '53 and no change is expected this year.

CONSUMPTION INDEX



Business Activity (Feb.) 306.7

Chemical Consumption Jan. (Prelim.) 288.2

Dec. (Rev.) 276.1

Indexes	Jan.	Dec.			
Fertilizer	68.01	68.84	Point & varnish . . .	26.40	22.52
Pulp & Paper	33.56	30.74	Textiles	10.63	9.76
Petroleum ref. . . .	29.61	29.18	Coal products	11.21	11.57
Iron & steel	16.21	15.20	Leather	3.80	3.74
Rayon	28.51	29.23	Explosives	7.64	7.78
Glass	23.55	19.79	Rubber	7.03	6.73
			Plastics	22.01	21.00

Tri-Sure[®] equipped drums are another feature of TRETOLITE CHEMICALS



When an oil producer or refiner needs help with a demulsifying, corrosion, or desalting problem, they can be sure a Tretolite product will do the job—because it's made right . . . it's delivered fast . . . and its purity is protected in *Tri-Sure[®] equipped drums*.

The Tretolite Company, maker of fine chemicals for the petroleum industry, has built its reputation on *service*. And as part of that service—part of a policy that protects customer's needs—is Tretolite's insistence on *Tri-Sure Closures on every drum*.

If *dependability* is a feature of your products, ship them in *dependable packages*—drums that deliver a pure product every time, because they are sealed from leakage and contamination by Tri-Sure Closures.

When you order drums, always specify "Tri-Sure Closures"—a good way to build good will.

*The "Tri-Sure" Trademark is a mark of reliability backed by over 30 years serving industry. It tells your customers that genuine Tri-Sure Flanges (inserted with genuine Tri-Sure dies), Plugs and Seals have been used.

AMERICAN FLANGE & MANUFACTURING CO. INC., 30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.
Tri-Sure Products Limited, St. Catharines, Ontario, Canada

In 1955 naphthalene will be tight, with imports dwindling and demand pressure growing from phthalic anhydride, which set an all-time high in 1954. More phthalic makers will examine the o-xylene route, and more petroleum companies will be checking refinery streams for o-xylene and naphthalene itself.

There should be no changes in production or consumption of tar acids. However, there is some chance of increased needs for meta-para cresol fractions of the acids. This could bring some imbalance since the other fractions, especially the higher boiling ones, aren't in similar demand.

► **Replacement and Expansion** — These days when a company installs coking facilities it usually includes equipment for recovery of byproducts. This capacity to produce coal chemicals is related directly to oven-coke capacity.

Government expansion goals called for 84 million tons of metallurgical coking capacity completed by Jan. 1, 1955. Actual capacity at that date was between 79 and 80 million tons. If all holders of certificates build, the total eventually will be reached. But some who have certificates quite definitely will not be building.

During the past year roughly 3.5 million tons of new coking capacity went on the line. Yet contrary to earlier expectations at year's end there was no increase in over-all capacity. Quite a few merchant and beehive coke plants shut down, due largely to continuing integration of the steel producers. The Iron and Steel Institute estimates companies are now about 95% self-sufficient cokerwise.

The current year will see another 3-3.5 million tons added to our facilities, but it's anybody's guess how much will be retired concurrently.

In 1953, integrated producers bought 3.6 million tons of coke from merchants. Last year they bought none. With natural gas pre-empting the coal-gas market, merchant coke producers face a bleak future.

► **New Technology** — A new ap-

proach to ammonia-from-coal is nearing the commercial stage. Late last year Ketona Chemical Corp. (owned jointly by Hercules Powder and Alabama By-Products Corp.) let a construction contract for a 45,000 ton-per-year anhydrous ammonia plant at Ketona, Ala. Plans call for startup late in 1955.

And at Geneva, Utah, U. S. Steel is committed to erection of an \$18 million, 70,000 ton-per-year anhydrous ammonia plant. Outsiders are looking for Big Steel to follow up with a second plant at Gary, Ind.

Both plants will tap coke-oven gas stream to get high-purity hydrogen for ammonia synthesis. Ketona will use low-temperature fractionation with apparatus from L'Air Liquide. U. S. Steel has not tipped its hand on its process but the betting is good that it too will be using some form of low-temperature separation.

With combined output from these plants running 115,000 tons per year interest will be keen to see how they fare. In the offing could be other moves to further exploit a nation-wide ammonia potential in coke oven gas of about 6 million tons per year.

In a quick side-stepping act Colorado Fuel & Iron Corp., Pueblo, Colo., has moved ahead of the pack of ammonium sulfate producers by converting to more-marketable diammonium phosphate. Operation is said to be the first DAP unit using feed streams of byproduct coke-oven ammonia and electric-furnace phosphoric acid. Material analyzes 74% available plant nutrients; ammonium sulfate runs only 20.5%.

On low temperature carbonization, behind-the-scene activity is perking in research and development groups. But Alcoa's lignite venture at Rockdale, Tex., is the only one that actually has advanced much. And it's said in some quarters that marketing the volatile fractions presents some problems. Tar acid content is high and not too usable since high-boiling fractions predominate, rather than regular commercial tar-acid fractions.

Latest work on underground gasification at Gorgas, Ala. by the Bureau of Mines is centered around using Stanolind's Hydrofrac process for fracturing underground strata prior to burning. As yet, burning tests have not been made.

Overseas, Americans are waiting for word on South Africa's \$100 million hydrogenation plant for converting coal into oil, due to start this spring. And in this country the Bureau of Mines has produced, in the laboratory, high yields of gasoline from coal by "single-step" hydrogenation.

All signs indicate science will continue to pry at coal's potential, hoping to broaden coal chemicals' basic economic foothold.

How Good's Your Basic Knowledge of Tariffs?

The current battle in Congress over whether to cut tariffs highlights the need all of us have to understand the complex subject of foreign trade. So we were pleased recently to receive a new booklet that presents, in a very readable way, some of the big problems raised by trade barriers.

Called "Innocence Abroad,"* it relates the adventures of Willoughby Lowdermilk, a young American executive trying to sell his firm's products around the world. Some points it tries to make are these:

- The U. S. already has a more liberal trade policy and lower tariffs than most countries.

- Efficient competition demands that competitors be placed on an equal footing. So where lower foreign wages hurt U. S. manufacturers the difference should be made up by tariffs on imports.

- It's bad economics to undermine our industry by lowering tariffs, then subsidizing the same industry with taxpayers' money.

- American concessions under reciprocal trade policy have not been reciprocated by equivalent concessions from other nations.

* Or World Trade in Ten Easy Lessons." Single copies free from American Tariff League, 19 W. 44th St., New York 36, N. Y.

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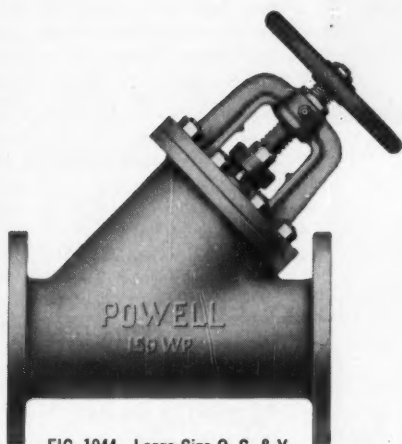


FIG. 1944—Large Size O. S. & Y.
"Y" Valve for 150 Pounds W. P.

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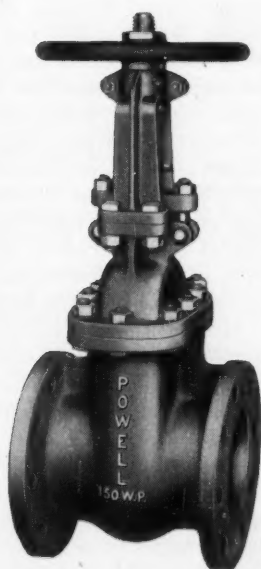
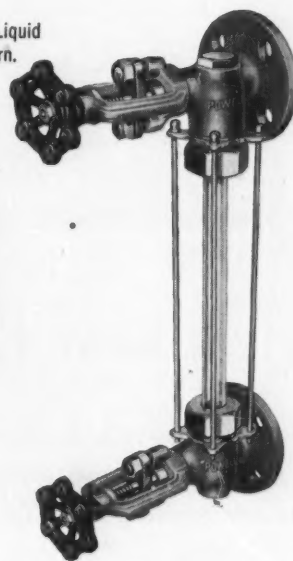


FIG. 2453G—Stainless Steel O. S. & Y.
Gate Valve for 150 Pounds W. P.



FIG. 2433SS—Stainless Steel
Bolted Cap Swing Check Valve
for 150 Pounds W. P.

FIG. 1891—Flanged End Liquid
Level Gauge. Offset pattern.



POWELL VALVES



BY BARGE, like Hooker's "Griffson" here off from Tacoma to Canada, and . . .



BY TANKER, either conventional or custom-built like the Dow-Chem . . .

Freight Keys Caustic Sales

Though chlorine-caustic output set records last year, some areas were glutted, others starved. So producers are looking hard for ways to cut freight costs.

Cecil H. Chilton, Senior Associate Editor

Although still operating at less than full capacity, the chlorine-caustic soda industry chalked up new production highs in 1954.

Chlorine production last year

was 2.89 million tons; caustic soda from electrolytic and lime-soda plants came to 3.39 million tons. Gains over 1953 were modest—between 3 and 4%—but significant.

► **Right Time, Place**—Logistics in the industry's chief problem right now. Most sales managers are greatly concerned with getting their products delivered to the right place at the right time in the right form and at the lowest cost.

The situation is felt most keenly, perhaps, in the Gulf Coast area. Dow Chemical, the industry's biggest producer, has taken several steps to alleviate the problem of moving its Freeport, Tex., caustic production into consuming channels. For examples:

- Dow last year put into service a custom-built tanker, the Marine Dow-Chem, for water transport of liquid chemicals from Freeport to East Coast ports. The ship's four stern tanks are specifically designed to carry 632,000 gal. of 73% caustic.

- The company installed additional 73% storage facilities at its Charleston, S. C., tank terminal.

- Construction started at Freeport on a unit for production of 300 tons a day of soda ash by carbonation of dilute electrolytic soda.

► **Freight Is the Key**—Many of the industry's recent moves are inspired by the need to keep freight costs as low as possible. Since ocean-going tanker shipping of liquid caustic is not a universal answer, most major producers are working on freight cost reduction via two other common procedures—barge shipment on inland waterways and shipment of concentrated (70-73%) liquid caustic. Another well defined industry trend—the grouping of satellite consuming plants around a chlorine-caustic plant—accomplishes the same result.

Hooker Electrochemical has incorporated all three of these principles into its new \$15 million plant at Montague, on Lake Michigan's eastern shore:

- Caustic is moving in two 400,000-gal. chartered lake barges either direct to customers or into a million-gal. storage tank recently erected on the Illinois Waterway at Lake River Terminal. A smaller (120,000 gal.) inland-waterway barge, Hooker-owned, carries caustic from the terminal to points in the Chicago area.

- Hooker recently added facili-

reach a new peak in spraying efficiency with YARWAY non-clog nozzles

cone spray

Most popular design for cooling, recooling, washing, rinsing, air conditioning, drying and other spraying operations in industrial and processing work and in power plants.

Non-clog involute design has no internal parts (vanes or deflecting plates) on which foreign particles can collect. Special contour of nozzle body guides flow with minimum loss of energy towards discharge opening, where liquid attains maximum velocity and leaves nozzle in a fine hollow-cone spray.

Available in three types:

Bar-stock bronze (shown) for fine spray

Sizes $\frac{1}{8}$ " and $\frac{3}{16}$ ", male or female connection

Capacities up to 3 gpm; pressures 20 to 50 psi

Cast bronze Type B (shown) for air conditioning and small recooling systems

Five sizes, $\frac{1}{2}$ " to $1\frac{1}{2}$ "

Capacities up to 40 gpm; pressures 7 to 25 psi

Cast bronze Type C (not shown) for spray pond service

Sizes 2" and $2\frac{1}{2}$ "

Capacities up to 110 gpm; pressures 7 to 15 psi

Write for YARWAY Spray Nozzle Book N-617; it gives capacities, dimensions and application information.

fan spray

Preferred for many washing and cooling operations. Non-clog design, delivers flat fan-shaped sheet of spray with slicing action particularly desirable for surface washing.

Thin sheet of spray is discharged forward 30° from the vertical, spreading in fan shape up to 140° , depending on operating pressure.

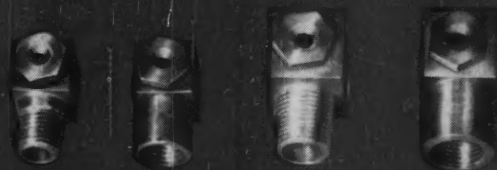
Made of bronze, steel or other bar-stock metals, male thread, six sizes $\frac{1}{8}$ " to 1", capacities up to 7 gpm, pressures up to 50 psi.

Write for YARWAY Spray Nozzle Book N-617.

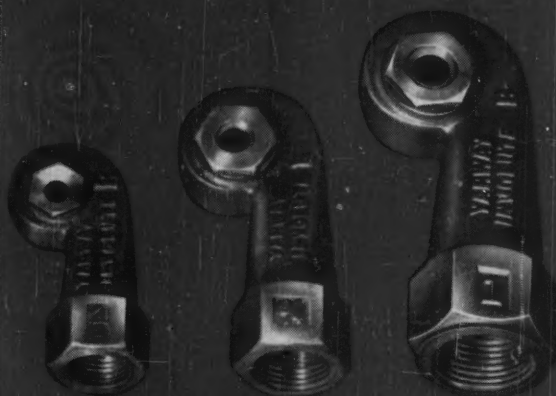
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BRANCH OFFICES IN PRINCIPAL CITIES



YARWAY Bar-Stock Involute Nozzles



YARWAY Type B Involute Nozzles



YARWAY Fan-Spray Nozzles

YARWAY

spray nozzles

ECONOMICS . . .

ties at Montague for production of 73% liquid caustic.

• Du Pont is building at Montague a neoprene plant which will siphon off, as HCl gas, an important part of Hooker's chlorine and hydrogen output.

► **New Plants**—Despite the present surplus capacity in the industry as a whole, new producers and new facilities are on the way to satisfy specific local demands. Here again, freight savings play an important role.

General Aniline & Film later this year will start up a new captive plant at Linden, N. J., to augment supplies in the New York metropolitan area. Closest merchant plants now are at Syracuse, N. Y., and Edgewood, Md.

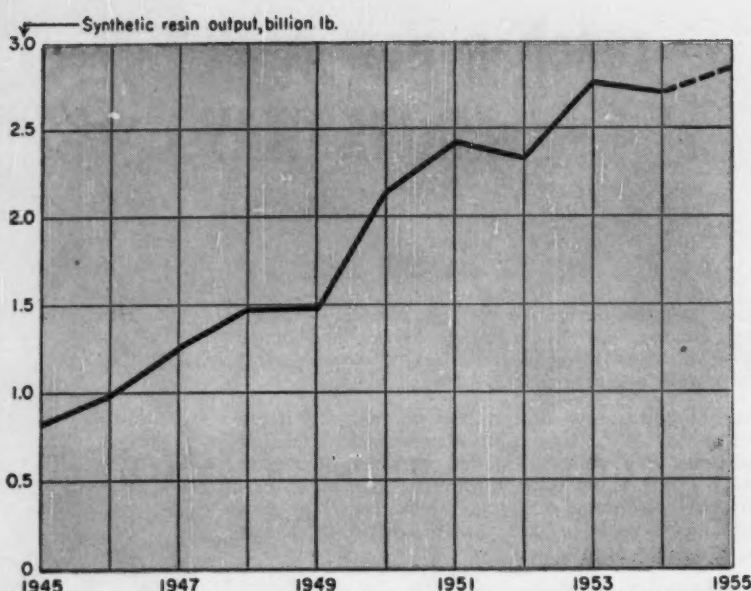
The booming pulp industry in the Pacific Northwest is creating a growing demand for chlorine and caustic in that area. This accounts for Weyerhaeuser Timber Co.'s recently announced plans to build its own electrolytic plant at Longview, Wash.

► **Shifting Markets**—In the end-use pattern for chlorine, chlorohydration is losing out to direct oxidation in the manufacture of ethylene oxide and glycol. Most of the recent growth in phenol has been via cumene, rather than by benzene chlorination.

Shoring up the demand for chlorine, however, are the old standbys: sanitation, solvents and pulp bleaching, plus the newer plastics, refrigerants and propellants. Added consumption by insecticide and titanium producers is expected to brighten the 1955 picture.

Caustic soda sales managers, having survived a slump in rayon and soap manufacturing and textile processing, are decidedly optimistic about this year's prospects. Rayon outlook is much brighter, more cellophane capacity is on the way, alkaline pulping is going strong, and synthetic detergents' rate of encroachment on soap manufacture is beginning to slow.

All told, the chlorine-caustic industry is in a good position to meet expected growing demands and to solve temporary, localized imbalance in supply and demand.



1955 Plastics Production: Up 5%

New and improved polymers, copolymers and blends—together with better fabricating techniques and expanding applications—are providing the impetus.

Bolstered by a last quarter spurt, last year's 2.71-billion-lb. synthetic resin output was only about 3% below the record set in 1953. Compared with general business, the plastics industry fared well.

For 1955 The Society of the Plastics Industry estimates that production will be up 5% over 1954—to 2.85 billion lb.—and that the value of all finished plastics product will hit about \$1.43 billion.

While production of some resins was down rather sharply in 1954, others were up slightly or actually registered substantial gain. Increased polyethylene output—up 51 million lb.—was the chief factor in keeping total 1954 volume close to 1953.

New sales and production records are in the offing for several

types of plastics. Here are today's situations:

► **Acrylics Depend on Copolymers**—About 40% of present consumption of acrylics is by the automotive industry. Acrylics are also widely used in large advertising display signs. And some acrylic sheeting goes to skylighting and electrical lighting fixtures in industrial plants.

The latter represents a major growth area. Main advantage is resistance to breakage. While glass costs only 30¢ compared with \$1.60 for acrylic sheet, low replacement cost allows unbreakable material like acrylics to compete.

Cars and trucks will undoubtedly continue as the most promising application for these materials, with a major shift in fabrication from cast plastics to extruded.

Future growth will probably depend on the use of acrylic resins either as copolymers for other thermoplastics, or on the use of

This article is based largely on a talk by John Walsh of A. D. Little before the New England Section of the SPI, Bretton Woods, N. H.

40

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can be planned for
lasting economy

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STATIONARY SPINDLE
TRAVELING SPINDLE
SCREW IN BONNET
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UNION BONNET
QUICK OPENING
SOLDER END
SOCKET END
plus RADIATOR, ROSE END
and UNDERWRITER GATES

**SOLID WEDGE, OR WEDGE
SCREW IN BONNET—ROSE END
TRAVELING SPINDLE**

**SOLID WEDGE
SCREW IN BONNET
TRAVELING SPINDLE**

**SOLID WEDGE
SCREW IN BONNET
STATIONARY SPINDLE**

**SPLIT WEDGE
SCREW IN BONNET
TRAVELING SPINDLE**

**SOLID WEDGE
SCREW IN BONNET
TRAVELING SPINDLE**

**SOLID WEDGE
OUTSIDE SCREW & YOKES
RISING SPINDLE**

FAST ACTION LEVER GATE

**SOLID WEDGE
OUTSIDE SCREW & YOKES
RISING SPINDLE**

**SELECT THE GATE
YOU NEED
FROM THIS
COMPLETE
ASSORTMENT**

SOLID WEDGE BRONZE GATES

Fig. No.	Weight	Pattern	Weight	Pattern
125 lb.	125 lb.	150 lb.	150 lb.	150 lb.
150 lb.	150 lb.	200 lb.	200 lb.	200 lb.
200 lb.	200 lb.	300 lb.	300 lb.	300 lb.
300 lb.	300 lb.	350 lb.	350 lb.	350 lb.

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ECONOMICS . . .

Production of Plastics and Resin Materials (Pounds)*

	1953	1954
Cellulose plastics.....	128,963,000	123,230,000
Phenolic, other tar-acid resins.....	482,942,000	396,610,000
Urea and melamine resins.....	257,310,000	253,280,000
Styrene resins.....	507,692,000	501,570,000
Vinyl resins.....	515,873,000	516,630,000
Polyethylene†.....	144,000,000	195,000,000

* U. S. Tariff Commission

† Estimated by Modern Plastics

other thermoplastic materials to improve the properties of acrylics. **► Cellulosics Growing**—Cellulosic resins are the oldest thermoplastics. After very limited growth from 1947 to 1952 they are now headed up again.

By far the most important are cellulose acetate and cellulose acetate butyrate. But though these have high impact resistance, they are more expensive than competing products such as polystyrene, polyethylene and polystyrene copolymers. Important uses are in car interiors (knobs, steering wheels, etc.), toys and housewares, telephone housings and packaging film.

Cellulose acetate butyrate pipe has a growing market in the oil industry as gathering lines. And rather promising growth exists for the use of cellulose acetate as tape for recording radio and television programs.

► Boom in Polyethylene—Easily the fastest growing thermoplastic is polyethylene, widely known through its use in squeeze bottles and packaging film. Production was only 11 million lb. in 1943, but announced expansion plans will bring U. S. capacity to 575-600 million lb. by 1957. However, fabricating capacity may well not be able to keep pace.

Copolymers and blends of polyethylene with other resins—for improved flame resistance, rigidity and temperature resistance—should materially broaden the present market. Also looming big are experimental types of polyethylene, made at low pressure, that are inherently higher melting and more rigid.

About 80% of polyethylene consumption is for civilian applications. Packaging (including film and squeeze bottles) accounts for half of consumption, electrical uses

for 30%. Pipe takes about 12%, with such miscellaneous uses as tanks and duct work accounting for the remainder. Packaging, electrical and pipe applications will continue to dominate the polyethylene end-use pattern.

► Styrenes: High-Impact—Polystyrenes, now the second largest of the thermoplastics, are growing fast. Major applications are molding compounds (66%) and protective coatings (20%). Of all toys, 26% are now made from plastics, including polystyrene and cellulosics.

Major growth will be in new copolymer materials, reverse ratio rubber and other high-impact materials. Copolymers may allow polystyrene to compete in areas where vinyls and polyethylene now predominate. Within five years, 50% of all polystyrenes will most likely be copolymerized with modifying resins.

Fabricators should watch carefully the development of vacuum forming of sheet because it will allow them to enter the market with low initial investment. It will also allow new products to be fabricated from polystyrene, since there'll be no restriction imposed by the size of present injection molding presses.

► Floor Covering for Vinyls—Present consumption of vinyl resins breaks down like this:

Molding, extrusion	27%
Sheeting	18
Film	13
Textile, paper treating	11
Adhesives	5
Protective coatings	5
Other	21

Biggest use of molding and extrusion materials is the coating of electrical wire and phonograph records. The vinyl film industry includes over 45 companies, the five largest of which are divisions of

companies that also produce resins. Nonintegrated producers account for 60% of the film used.

Major growth area for vinyls is probably in floor coverings. Vinyl floor tile is just beginning to assume an important position. Another growth field is fabrication of rigid polyvinyl chloride into piping, ducts and other industrial applications. Vinyl foams may also be important soon.

► Bigger Phenolic Moldings—Biggest of the thermosetting resins are phenolic materials. Growth's been due largely to continually expanding consumption in established products. Molding compounds now account for nearly 50% of this consumption.

Included in the many uses for phenolics are two relative newcomers: shell molding resins and wood waste board resins. These are sure to play a big part in the future of this industry.

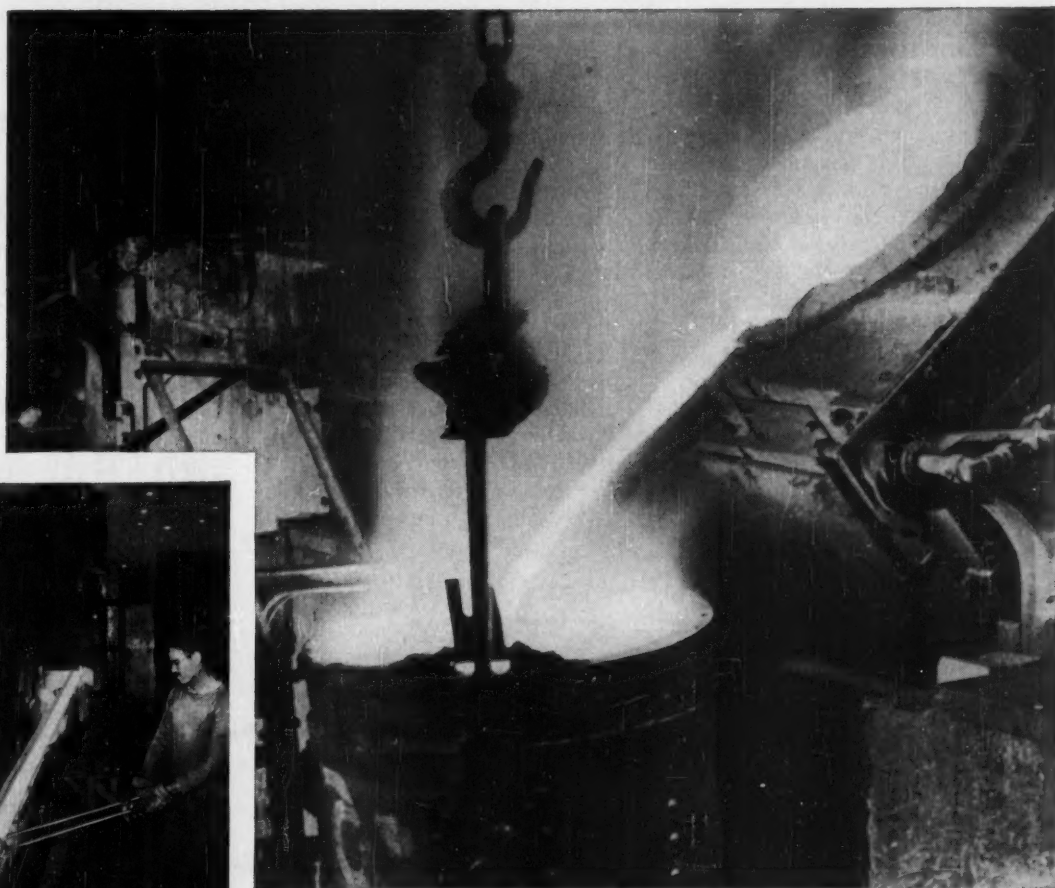
About 10 million lb. of phenolic resins are now being used by over 100 foundries to bind sand into shells. Molten metal is then poured into the shell to form a casting. This use alone could eat up 80 million lb. of resin in the foreseeable future. And wood waste can now be incorporated with about 7% phenolics and pressed into board that's cheaper than plywood and which can replace plywood in some furniture uses.

Today's techniques permit molding of 80 lb. of resin per cycle to produce such items as television cabinets. Two years ago a 15-lb. part was considered maximum. This field of large moldings will probably contribute more to the growth of phenolics than any other.

► Ureas Need Better Molding—

Coming Next Month

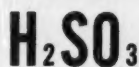
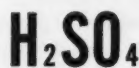
The eighth annual McGraw-Hill survey of industry's capital spending plans. And an economic review of the Portland cement industry which, due to feverish building activity, is really booming.



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to withstand hot acids
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Nickel Alloys

Where can Nionel be used? To handle sulfuric acid in many chemical processes and in petroleum refineries, detergent plants, rayon production and ore treatment. To handle sulfurous gases and condensates and pulp digester cooking liquors. In equipment for phosphoric acid production. In heat exchangers using chloride-containing cooling waters. And many other applications.

What forms are available? All standard mill forms, including plate, seamless condenser tubing, pipe and extruded tubing.

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ECONOMICS . . .

Though somewhat inferior to phenolics in physical properties, urea resin molding compounds have the very great advantage of unlimited color properties. However, their use in large parts has been limited by molding difficulties. Another disadvantage is higher cost.

Main uses now are in adhesives (45%), molding compounds (28%) and textile treating (13%).

► **Melamines Limited**—Melamine resins are probably the least-known of thermosetting molding compounds. Yet they have better properties than phenolics and all the color advantages of ureas.

Growth has been restricted by shortage of the basic material, melamine, but is expected to get better. Present end uses are:

Molding materials	29%
Laminating resins	21
Paper treating	20
Surface coatings	14
Textile treating	13
Adhesives	3

► Polyesters Need Mass Production

—Most publicized resins are the polyesters, ballyhooed across the nation for uses such as car bodies. Because of excellent chemical resistance, temperature resistance, light weight and high strength, they were used during the war in helmets, gasoline tanks and the like. Now consumption is up to about 27 million lb., largely because of improved techniques in handling and lower cost of glass.

Main use today is still in military items (50%). Others are corrugated transparent architectural sheeting, sailboats, bread trays and trailer truck bodies. Potential volume applications are pipes and car bodies.

High cost and slow production rates will prevent the use of polyester-glass materials in the fabrication of parts that can be easily and cheaply stamped from metals. However, where a small number of automobile bodies are produced, it's undoubtedly cheaper to use polyester-glass.

But this technique is facing competition through use of glass-reinforced epoxy dies to form metal parts for bodies made in relatively few units. These dies can be made quickly and cheaply.

Any boom for polyesters must

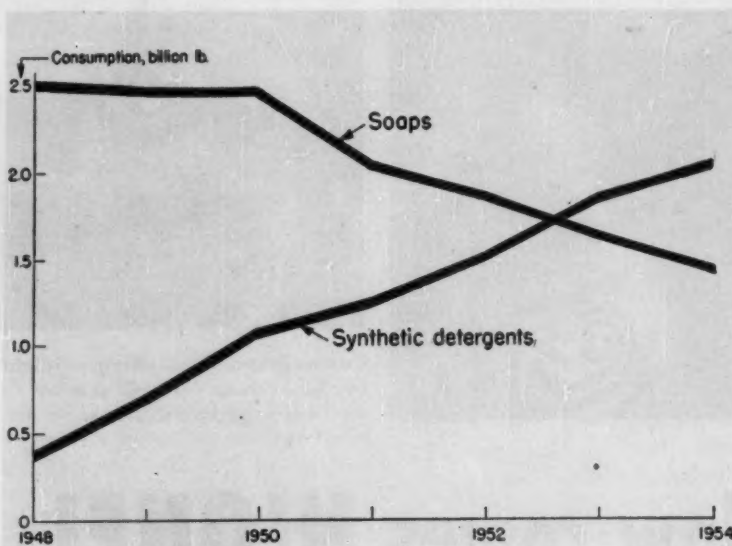
await mass production techniques. Future expansion will depend largely on the development of suitable civilian uses where the material's light weight, high strength and corrosion resistance are necessary.

Production will probably not top 60 million lb. by 1957. But if the right low-cost production methods can be developed, a 200-million-lb. market is likely.

► **Molding Epoxies Coming**—Epoxy resins are the newest of the thermosetting materials. While 85% of them go into surface coat-

ings now, continuing development work (possibly with copolymers and alloys) will almost certainly produce a material suitable for molding, one that might well compete with alkyds and phenolics.

In general, the development of copolymer materials—whether they be acrylics with vinyls, epoxies with phenolics, or even epoxies with vinyls—represent a major growth field for plastics. Many copolymers will be developed and though some will have limited use others may well turn out to have extremely wide distribution.



Detergents Widen the Gap

Detergent sales set a new record last year, while soap consumption dropped another notch.

Hugh T. Sharp, Assistant Editor

Synthetic detergent sales reached a record level again in 1954. Paced by sales of liquids and non-ionics, they topped the 2-billion lb. mark* and grabbed off nearly 60% of the entire soap and detergent market.

Significantly, however, the syndet's rate of growth has slowed perceptibly. Last year's sales were

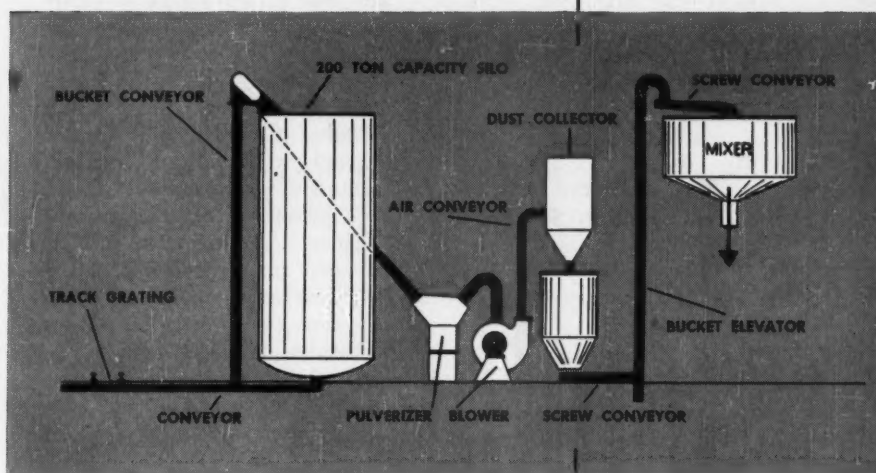
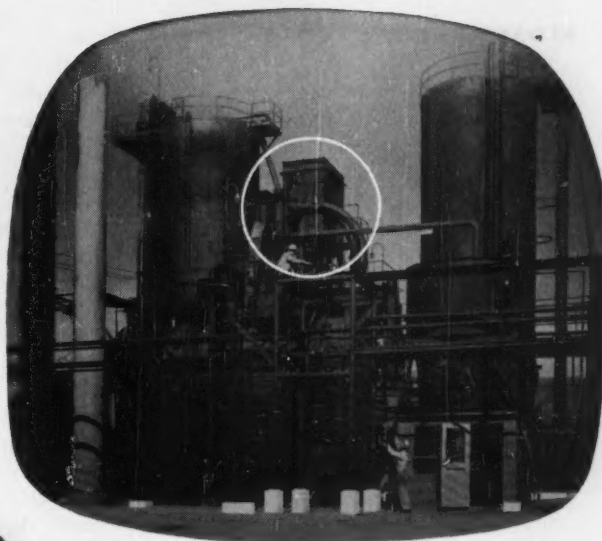
only about 10% higher than 1953's. In previous years sales jumped about 20-25% per year.

► **Soap Still Slips**—Last year's soap consumption fell some 12% below the '53 figure—continuing a 7-yr. skid in popularity. Dollar sales were down only about 1%, however,—from \$321.2 million to \$317.9 million, according to the American Soap and Glycerine Producers Association.

* On an "as sold" basis.

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ECONOMICS . . .

A changing pattern in consumer purchases of household soap products accounts for the relatively small dollar drop. The housewife is spending a bigger percentage of her soap dollar for the higher priced toilet soaps, while the percentage going for powders, flakes and chips is dropping. Toilet soap purchases now take close to 50¢ of every dollar spent for soap.

Despite the slide in soap sales and the slowdown in syndet's hitherto fantastic growth rate, total consumption of soaps and detergents was 3.15 billion lb.—about the same as in 1953. And dollar sales climbed from \$746.6 million in '53 to \$793.4 million.

► **Liquids in Demand**—Liquid soap sales were also somewhat slower last year—winding up about 10% below '53's 40 million lb. This represents a considerable drop when compared with the rocketing rise of liquid syndet sales.

This expanding market gobbled up 118.8 million lb.—a hike of 25% over 1953. It now accounts for almost 6% of the total detergent market, and strenuous promotion efforts seem likely to widen the wedge.

► **Low Sudsers Gain**—Combining high detergency with low sudsing properties, nonionics are helping set a swift pace in the syndet race. Booming popularity of automatic clotheswashers and dishwashers—which often have foaming problems when run with suds-making anionic or cationic types—have helped them catch on in the consumer market.

The two prime producers of non-ionic syndets were joined last year by the soap industry's "Big Three" (P&G, Lever, Colgate) in vying for this market. And sales* climbed 15% over 1953's total, to roughly 20% of the total synthetic detergent market. Extensive promotion of these products and increasing sales of automatic washing equipment bid fair to boost their already high standing in the market.

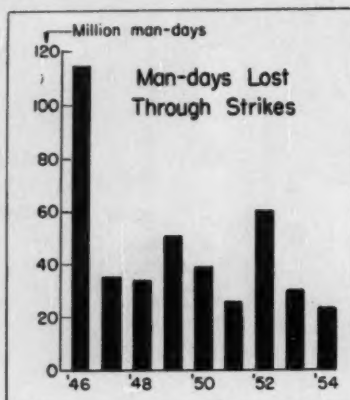
► **Trends Developing**—Besides the two trends already mentioned, the

swing to liquids and nonionics, others are discernable:

- Total soap and detergent market will continue expanding. For the past 20 years, per capita consumption has stayed pretty constant. Hence, total consumption should rise with population.

- Synthetics will continue to gain while soaps lose. Syndets are now even edging into the toilet bar field, soap's last refuge.

- Product specialization is growing. New products and products with specific characteristics are being developed to meet specific problems. And new processes, such as sulfonation with liquid SO_3 , (*Chem. Eng.*, Aug. 1954, p. 124), promising higher purity for specialty products, are catching on.



Fewer Strikes—Less Hours Lost in 1954

Total number of man-days lost through work stoppages hit a new postwar low last year, according to a recent survey by the National Association of Manufacturers. And not only were there fewer strikes than in any year since World War II except 1948, but on the average, fewer workers were involved in each strike and the strikes were of shorter duration than in former years.

Most of the strikes in 1954, says NAM, were local in character, in contrast to the peak lost-time years of 1946 and 1952. In those years the total of man-hours lost through work stoppages was swollen by prolonged strikes in basic industries.

Faster Depreciation Meets Mixed Reactions

Almost half (45%) of 167 manufacturers recently surveyed by the National Industrial Conference Board are changing their depreciation policies to take advantages of faster tax write-offs permitted under the 1954 tax code.* About 35% of the cooperating firms have definitely decided to keep their present policies (many point out that they can change later if conditions warrant). The rest are still studying the problem.

Although faster depreciation was enacted to stimulate expansion and modernization of plants and equipment, NICB found that 50 of the 75 firms that have changed their policy say the change will not influence their capital spending. Factors such as product demand, technological improvements and available cash are still the dominant considerations.

Those companies that feel accelerated amortization will stimulate their capital spending generally expect to boost outlays for modernization rather than expansion. Only a few believe the new law will aid expansion and even these expect the influence to be slight.

► **Reasons for Changing**—Companies that have switched from a straight-line basis to an accelerated basis report that the new system not only provides more rapid recovery of funds, but also cuts current taxes and results in more realistic valuation of assets.

According to the survey, firms making the change are doing so only after careful investigation of the long-term effects. Reporting companies favor the sum-of-the-years-digits by a two-to-one margin over alternative methods. This method's popularity is attributed largely to the fact that it allows about three-fourths of the total cost of new property to be written off during the first half of useful life.

► **Reasons for Not Changing**—NICB found that companies that

* Excluding certain lauric, oleic and stearic acid esters classified as nonionics by the U. S. Tariff Commission.

* For a detailed discussion of all the depreciation methods now available, see *Chem. Eng.*, Dec. 1954, p. 172.

WILFLEY ACID PUMPS

Wilfley Acid Pumps have the enviable reputation for efficiency and economy. They operate without attention, delivering trouble-free, cost-reducing performance on "round-the-clock" schedules.

Available with pumping parts of the machinable alloys, as well as plastic, to meet all requirements. Individual engineering on every application. Write or wire for complete details.

Wilfley Model "AF" Pump with wetted parts of durable, corrosion-resistant plastics.

for
HCl

FeCl_2

CuCl_2

NaOH

KCl

H_2SO_4

and other
solutions



Wilfley Acid Pump
"COMPANIONS IN ECONOMICAL OPERATION"

Wilfley Sand Pump

A. R. WILFLEY & SONS INC. DENVER, COLORADO, U. S. A.
NEW YORK OFFICE: 1775 BROADWAY, NEW YORK CITY

ECONOMICS . . .

have decided not to change had these reasons: value of new equipment is small; nature of the equipment doesn't lend itself to fast depreciation; apprehension over the Bureau of Internal Revenue's interpretation of the law; desire for stable rate of write-offs; preference not to gamble on tax rates; satisfaction with the present method.

Most companies planning to accelerate see no serious or overriding disadvantages to the new system. But many have certain misgivings. Generally these are the same ones

that led other firms to keep their old systems, or to defer decision until the shortcomings can be better evaluated.

Depreciation policies are not frozen. Some companies will review their depreciation methods as new acquisitions are made. Others say they'll watch tax rates and tax decisions closely. Some manufacturers may go to acceleration when their emergency facilities are completely written off. Also, some that have accelerated may later return to the straight-

line method (allowed under certain conditions).

Of the companies planning to change methods, 25% foresee some change in their differentiating between depreciation accounting for tax and book purposes. Firms that favor a "conservative" practice will maintain their internal accounts on a straight-line basis and take acceleration solely for tax purposes. But some that have been writing off at a faster rate for internal purposes than for taxes expect to reconcile the two accounts.

GUIDED TOUR CONTINUED

PICTURED FLOWSHEET

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Two ways to refine . . .

. . . vegetable oils: caustic process and modified soda ash process. Which is better? This flowsheet gives basic technology and economics of both. (p. 326)

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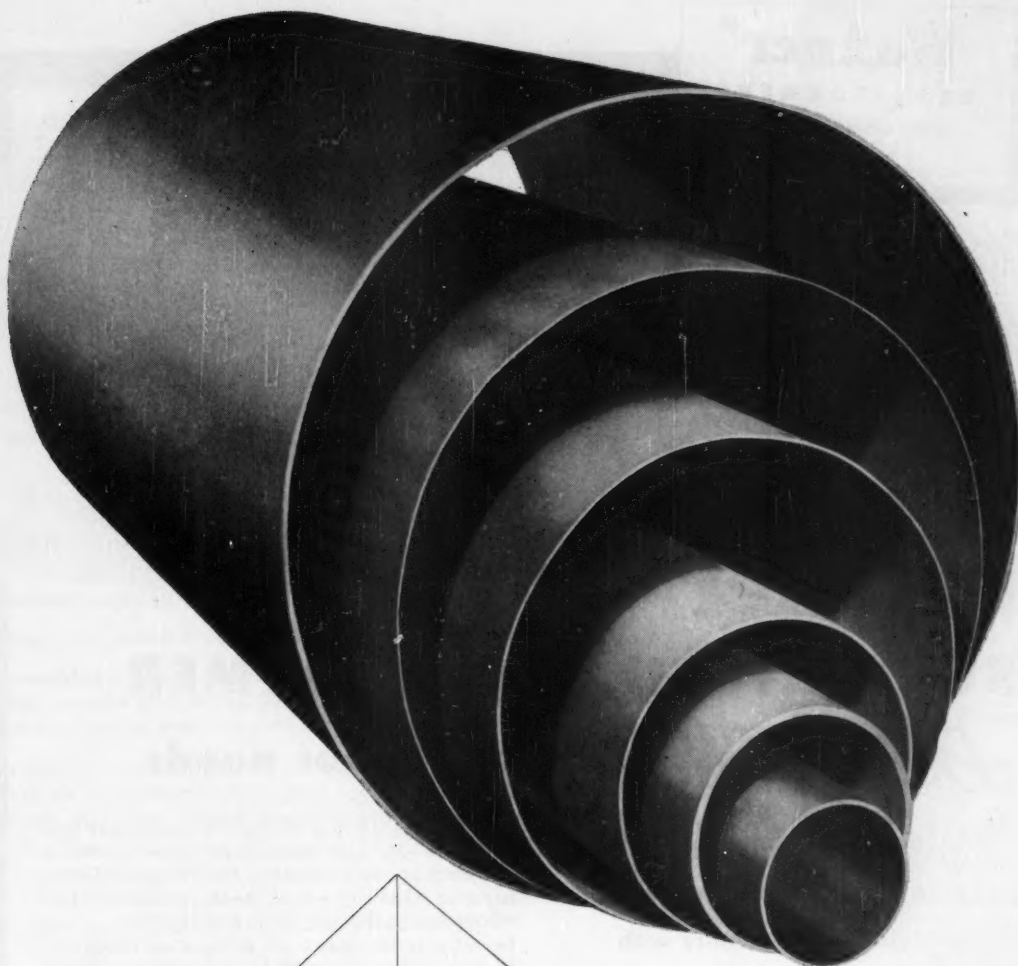
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Inside Back Cover

May 1955—CHEMICAL ENGINEERING



make it TRENTWELD

There is a Trentweld Tubing to fit
all your requirements

Aircraft Tubing
Beverage Tubing
Formed Tubing
Heat Resistant Tubing
Large Diameter Tubing
Mechanical Tubing
Ornamental Tubing
Pressure Tubing
Shaped Tubing

TRENTWELD

STAINLESS STEEL TUBING

TRENT TUBE COMPANY, GENERAL SALES OFFICES, EAST TROY, WISCONSIN (Subsidiary of CRUCIBLE STEEL COMPANY OF AMERICA)

CHEMICAL ENGINEERING—May 1955

for dimensional accuracy . . . physical uniformity

Back of TRENTWELD tubing's reputation for trouble-free service is its manufacture by *tube mill specialists*. But it is not the welding alone — it is the Trentweld process after welding that makes it superior to other tubing.

That's why TRENTWELD means accurate, uniform tubing . . . with excellent corrosion resistance . . . high strength and light weight. And TRENTWELD's smooth surface is easy to clean. It's the right choice where long life and efficient performance are needed.

Important, too, is Trent's wide range of sizes, shapes and grades — the largest in the industry. $\frac{1}{8}$ " to 40" OD are standard, and even larger sizes can be supplied if you need them. So whatever your tubing requirements are, remember, *you can't buy better tubing than TRENTWELD.*

Wagner®
TRANSFORMERS
 ... the choice of leaders
 in industry

*No matter what
 your load-center
 requirements...*

you can specify a

Wagner

SUBSTATION TRANSFORMER

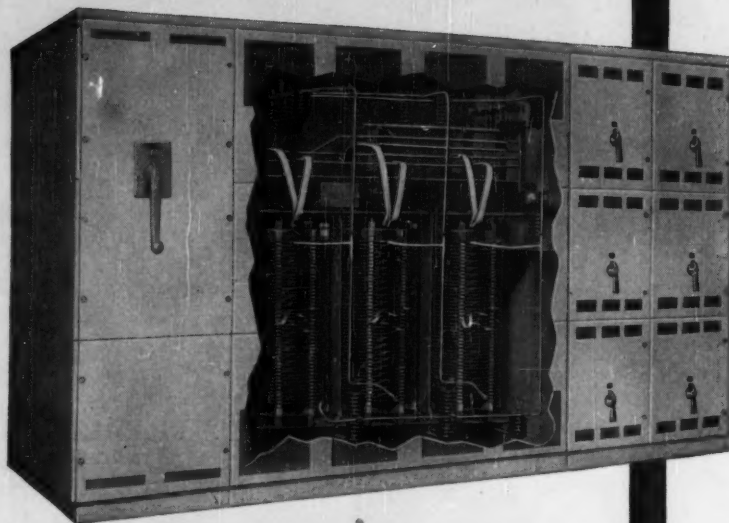
PREDESIGNED to meet your needs

- ✓ save shipment time ...
- ✓ save job engineering costs ...
- ✓ get full Wagner Quality with switchgear of your choice

Wagner "Predesigned" standard unit substation transformers are carefully engineered to meet heavy industrial demands—they are not designed for minimum duty only. Predesigning completely eliminates individual job engineering time... reduces your costs... and permits quick delivery.

When you specify Wagner "Predesigned" transformers you get the advantages of a proved design in a completely assembled transformer, tested at the Wagner factory. They are built in standard ratings which are coordinated with the specifications of all unit substation builders.

Wagner builds a complete line of substation transformers—open, ventilated Dry-type, Oil-Filled, Noflamol, and sealed-dry-type Nitrogen Filled—in ratings from 112½ through 2000 kva, 15 kv and below, to handle practically any distribution requirements.

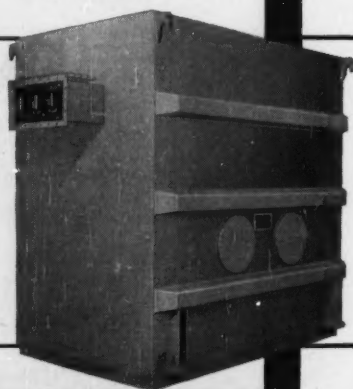


You can specify the Wagner Transformer that exactly meets your load-center distribution requirements—be assured of full Wagner Transformer Quality—and gain a substantial advantage in delivery time and in cost.

Investigate the many advantages of specifying Wagner "Predesigned" Unit Substation Transformers for your next load-center installation. Consult the nearest of our 32 branches offices, or write for Wagner Bulletin TU-205. It gives full information on Wagner Unit Substation Transformers for industrial power distribution systems.

**SEALED-DRY-TYPE
 NITROGEN FILLED**

Wagner's nitrogen-filled transformers offer many advantages in maintenance and safety. They are relatively unaffected by water—they require only a minimum of maintenance—they present no cleaning problems, even in dust-filled areas. They have exceptionally high overload capacity, and are completely fire and explosion proof. Available in ratings up to 2000 kva.



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BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

ELECTRIC MOTORS
 TRANSFORMERS
 INDUSTRIAL BRAKES
 AUTOMOTIVE
 BRAKE SYSTEMS—
 AIR AND HYDRAULIC

T55-1

will PELLETING

improve your product or process?

Check the following pelleting advantages. Relate them to your materials and processes. You may discover new ways to cut your costs and improve your products and your process.

1. Pelleting reduces or eliminates the dusting characteristics of materials.
2. Pelleting helps preserve original moisture content, chemical analysis and other properties.
3. Pelleted materials flow freely, can be binned, sacked, and packaged easily.
4. Hard, shiny pellets have greater sales appeal than loose material.
5. Densifying materials-in-process through pelleting improves their filtering qualities, permits granulating, and decreases dispersion rate. It also greatly increases density, facilitating storage and shipment.

Such materials as ammonium chloride, insecticide dusts, clay, citrus meal for use as an antibiotic carrying agent, fertilizer, granular hygroscopic products, and many others are often pelleted to great advantage.

Let a Sprout-Waldron Man survey your products and processes—without cost or obligation—with an eye to increasing your profits. Sprout-Waldron's equipment and vast experience in *adaptioneering* pelleters for use in many fields may be of value to you. Write for details!

SPROUT-WALDRON CONTINUOUS PELLETER

This machine produces top-quality pellets in tremendous volumes at reasonable investment and low operating cost. Small and large pellets—even 1" cubes—can be produced in many shapes and sizes. Pellets 3/16" in diameter and 1/4" long can be produced from some materials at capacities of 10 tons or more per hour with only 75 h.p. The advanced features of this machine are unequalled in the industry.

Quiet V-belt drive.

Exclusive hinged die casing for easy access.

Corrosion-proof, stainless steel construction of feeder-conditioner and spout.

Revolving die cover and material-lifting flights assure long roll life . . . greater capacity.

Entire mill uses only 4 standard main bearings. Overall height, only 5 ft.

(A smaller sized model is also available.)

WRITE FOR DETAILS!

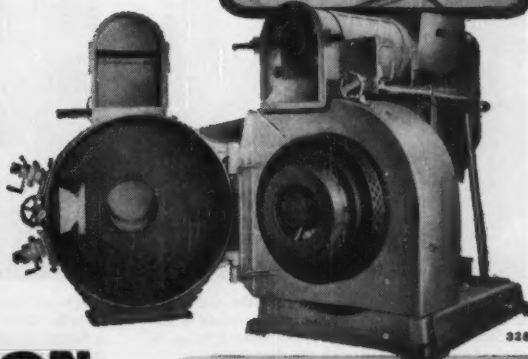


SPROUT-WALDRON

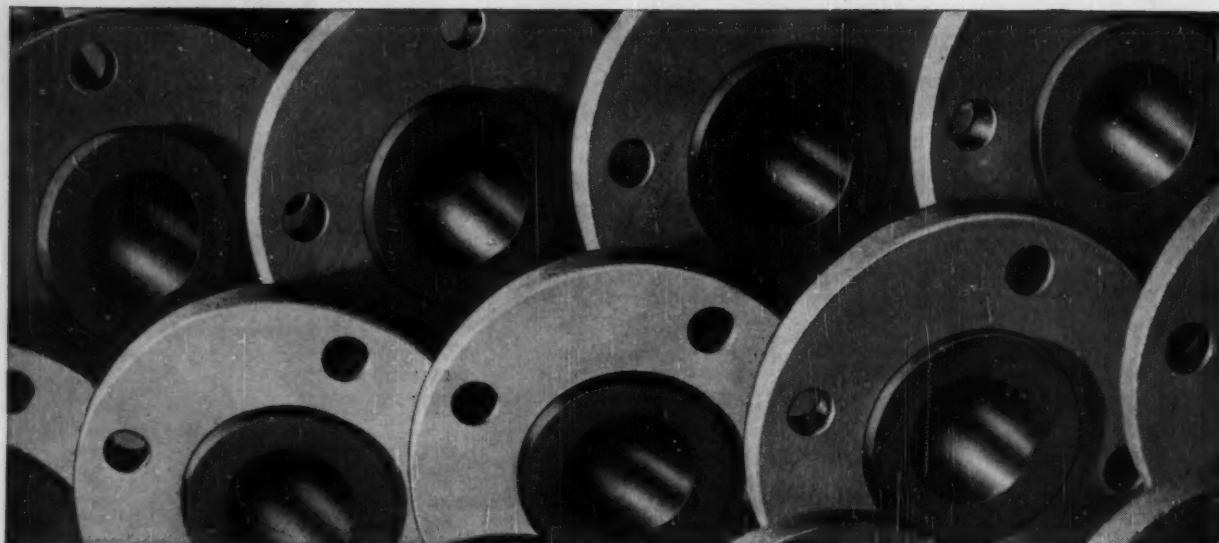
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Facilities for fabricating, machining, custom founding, woodworking, laboratory testing
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YOUR INVESTMENT PROTECTED
Our 88 years of service to industry is good assurance that you can obtain parts and service for the life of your Sprout-Waldron equipment.



You can see why

SARAN LINED PIPE

GIVES LONG, TROUBLE-FREE SERVICE

It's made of corrosion-resistant saran pipe swaged into steel for extra rigidity and strength . . . cuts downtime losses conveying corrosive liquids.

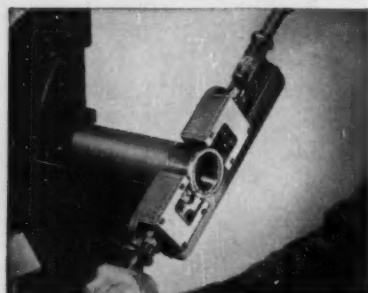
Now you can convey chemicals and many other corrosive liquids without worrying about costly shutdowns due to corrosion. For saran lined pipe, fittings and valves are corrosion-resistant . . . form snug, leakproof joints . . . which won't burst up to 150 pounds working pressure.

They're easily and inexpensively installed because they can be cut and threaded in the field with any standard pipe fitter's tools. Their rigidity means that few supporting members are needed.

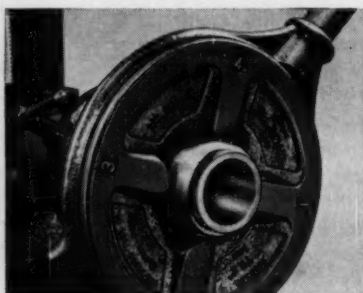
Saran lined pipe, fittings and valves have a proved record in industry of bringing long trouble-free service. If your operation requires superior resistance to most chemicals and solvents, be sure to investigate saran lined pipe. Contact the Saran Lined Pipe Company, 2415 Burdette Avenue, Ferndale 20, Michigan, Department SP527A-1.

RELATED SARAN PRODUCTS—Saran rubber tank lining • Saran rubber molding stock • Saran tubing and fittings • Saran pipe and fittings.

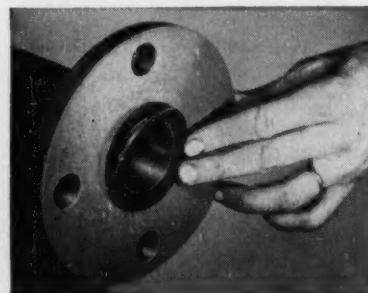
Saran Lined Pipe Can Be Fabricated Right in the Field!



An adapted Beaver Cutter cuts away the end of the steel pipe so that $\frac{1}{8}$ " of the saran lining is extended. This assures a tight seal after a flange is applied and connected with another flange.



A ratchet type thread cutter makes the standard threads after the Beaver Cutter has been used. A flange or union fitting is attached and tightened until the liner is flush with the fitting.



If two flanges, or a union fitting, are used to make a pipe connection then a full gasket is required. If a flange is made up against a flange fitting or spacer then a half gasket is required.

Saran Lined Pipe is Manufactured by
The Dow Chemical Company, Midland, Michigan

you can depend on **DOW PLASTICS**

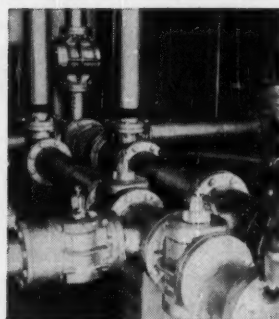
DOW

ROUND HOLES FOR ROUND PEGS

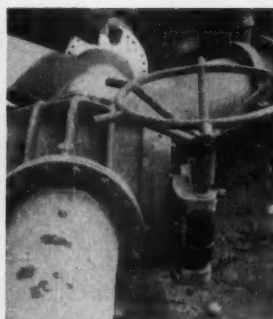


That's an elementary lesson. And that's one of the big advantages of **QCF** Cylindrical Round Port Valves. Because they are the exact size and shape of the pipe itself... they assure smooth, unrestricted flow of the most heavy viscous ladings. No obstructions. No loss in head pressure. No turbulence and harmful abrasive effects from solids in suspension. Just the utmost in flow perfection!

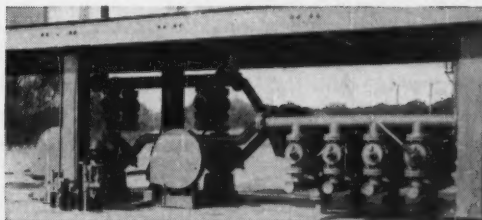
Remember, too, both **QCF** Round Port Valves and Rectangular Port Valves feature quarter-turn shut-off... full pipe area opening... and non-wedging design. All together... these advantages add up to extra long, trouble-free service life that really *s-t-r-e-t-c-h-e-s* your maintenance budget. Representatives in 50 Principal Cities. Write for descriptive Catalog 5, **QCF** Industries, Incorporated, Valve Division, 1501 E. Ferry Avenue, Detroit 11, Michigan.



Proved Best on
Raw Sewage Lines



On Chemical Plant
Applications

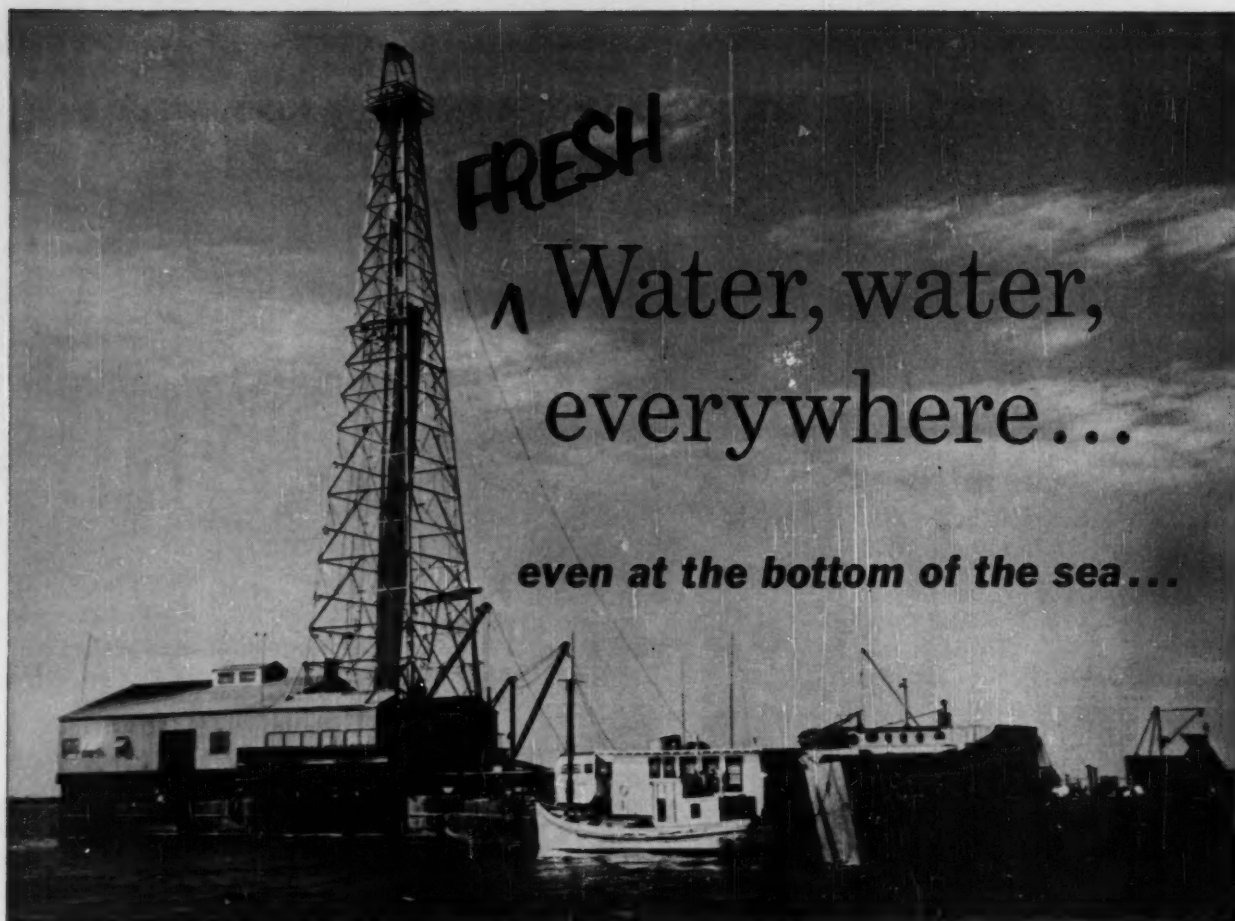


In the Petroleum Industry

QCF



PLUG VALVES



FRESH

**Water, water,
everywhere...**

even at the bottom of the sea...

with BRIDGEPORT CONDENSER TUBES

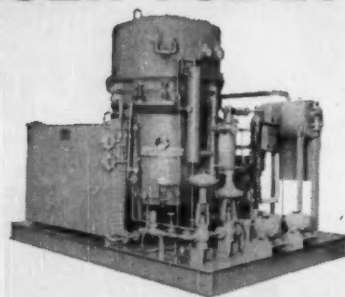
Distilling fresh water from the sea is one of many services Bridgeport Condenser Tubes perform dependably and economically.

The reason is simple, and important. Bridgeport Tube Alloys are carefully selected to meet the conditions in each application... assuring you the most effective performance possible over the longest time. The *right* alloy handles each job, whether in marine or stationary

power plants, chemical or process plants, refineries or off-shore drilling rigs.

You get the biggest return possible, in terms of service, from your condenser tube dollars.

Bridgeport Technical Service will be glad to analyze your application and recommend the Bridgeport Condenser or Duplex Tube best suited to your operating conditions.



Pure, fresh water for drilling mud make-up, engine cooling, and drinking is distilled from the sea on this rig by a Cleaver-Brooks Sea Water Evaporator equipped with Bridgeport Arsenical Admiralty Condenser Tubes.

BRIDGEPORT BRASS

COMPANY ♦ BRIDGEPORT, CONNECTICUT

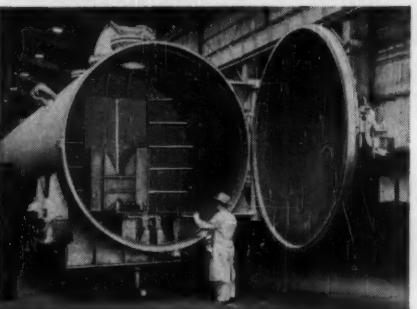
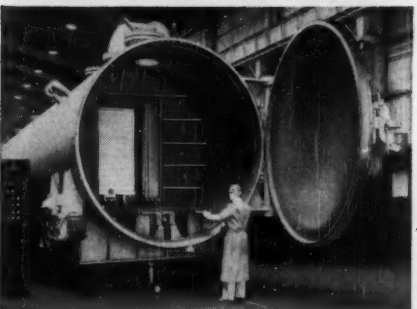
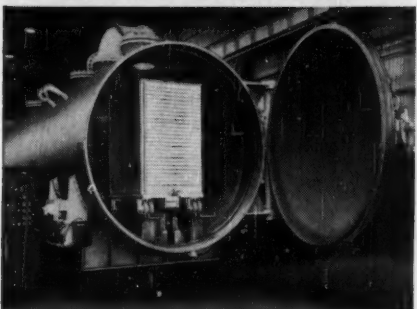
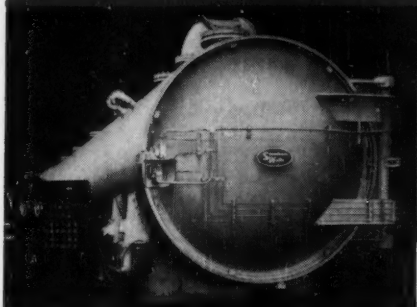
Serving Industry with a Nationwide Network of Conveniently Located Sales Offices and Warehouses.

Mills at Bridgeport, Conn., Indianapolis, Ind., and Adrian, Mich.

In Canada: Noranda Copper and Brass Limited, Montreal



*Continuous Pressure
Curing Oven*
*made
completely
automatic*



with STRUTHERS WELLS
QUICK OPENING
BOLTLESS DOORS PATENTED

Carts loaded with material to be pressure cured move through this 10' dia x 128' long continuous pressure curing oven—by "push button" control. Doors, elevators, bridges, etc. incorporated in the design of this special purpose autoclave are hydraulically operated and controlled by solenoid-operated valves.

"Quick Opening Doors" on charging and discharging ends of the vessel require only *21 seconds* for unlatching and opening. Other automatic operations are the result of Struthers Wells advanced engineering achievements—with Quick Opening Doors providing the means for complete automation as shown in the sequence of photos illustrated at left.

Consult Struthers Wells for Quick Opening Doors best suited to your requirements.

Write for Bulletin SW-553



STRUTHERS WELLS CORPORATION

TITUSVILLE, PENNSYLVANIA

PLANTS AT TITUSVILLE AND WARREN, PA.

Offices in Principal Cities

Handling waters?

Do it better, cheaper...with

ALCOA ALUMINUM

DISTILLED WATER is regularly stored and piped in equipment made of ALCOA Aluminum. Neither hot nor cold distilled water attacks aluminum. A recent survey of thirty distilled water systems revealed that the water in all-aluminum systems was maintained at a higher purity than water from systems fabricated from other materials of construction.

DEIONIZED WATER of high quality has no action on ALCOA Aluminum. Uncontaminated rain water will not corrode aluminum either.

TAP WATERS vary greatly in their action on aluminum. While fresh and salt waters in the pH range 4.5—8.5 never cause general attack of aluminum even at the boiling point, certain of these waters cause pitting because they contain traces of heavy metal salts. Alclad aluminum alloys prevent perforation under these circumstances and generally are recommended for equipment handling fresh or salt water.

RECIRCULATED WATER. ALCOA Aluminum may be used with practically all recirculated waters. It often is desirable in the case of closed and cooling tower systems to employ inhibitors. Where inhibitors are uneconomical, Alclad alloys or cathodic protection may be effective.

ACID MINE WATERS. Aluminum alloys are employed for handling acid mine waters containing sulfides and sulfates. Although moderately corrosive to aluminum alloys, these waters are enough more corrosive to steel to make aluminum the economical material to use.

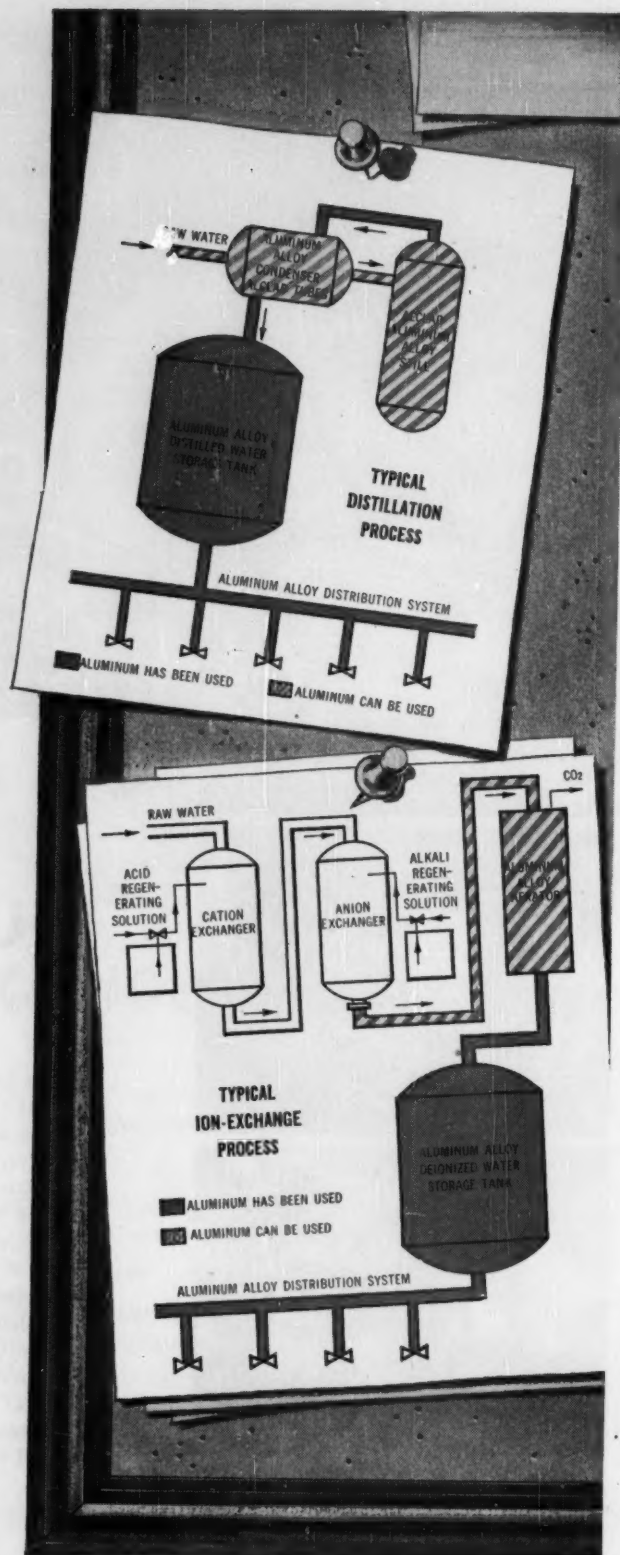
SEA WATER. In sea water, aluminum alloys show high resistance to attack. ALCOA wrought alloys 1100, 3003, Alclad 3003, 3004, Alclad 3004, 5052, 5054, 6061, Alclad 6061 and 6063 are preferred along with Alcoa coast alloys in 43, B214 and 356. Particular attention should be given to galvanic factors in design of equipment of service in sea water because of its high conductivity.

STEAM. Dry steam does not attack aluminum at temperatures up to 450°F. However, wet steam containing alkaline boiler compounds may be corrosive. The presence of carbon dioxide in steam is not harmful to aluminum. When aluminum steam lines or radiators are used, suitable traps should be installed to prevent carry-over of boiler compounds.

ALCOA's development engineers have firsthand experience with hundreds of such applications. To get in touch with them, simply write (on your company letterhead) to:

ALUMINUM COMPANY OF AMERICA
900-E Alcoa Building, Pittsburgh 19, Pa.

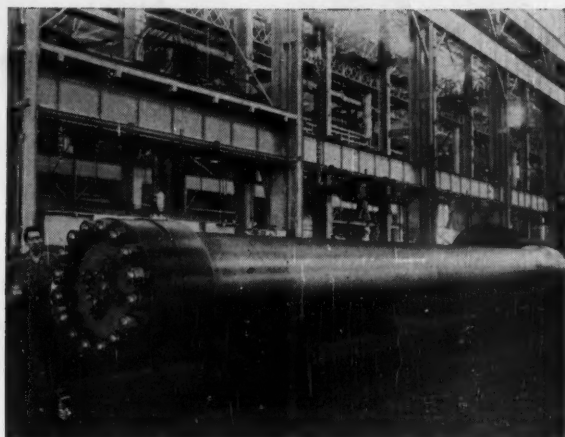
Write today for our new, FREE book,
Process Industry Applications of Alcoa Aluminum



ALCOA 
ALUMINUM

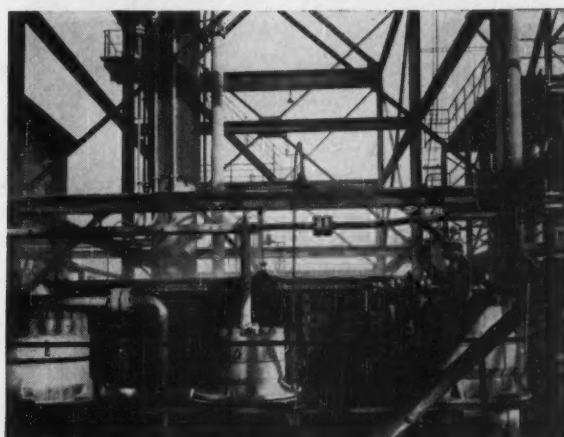
ALUMINUM COMPANY OF AMERICA

MIDVALE MAKES IT STRONG FOR AMMONIA



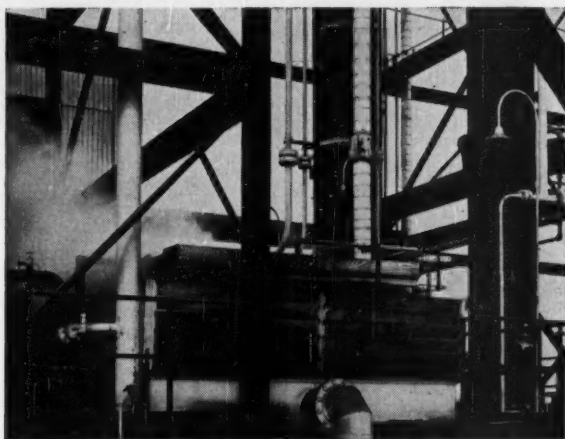
VESSELS START RIGHT

... at the Midvale furnace. The heads and the body of this ammonia converter were made from a combination of electric and open-hearth heats. This is typical of the ways in which Midvale uses its vast facilities to meet customer specifications.



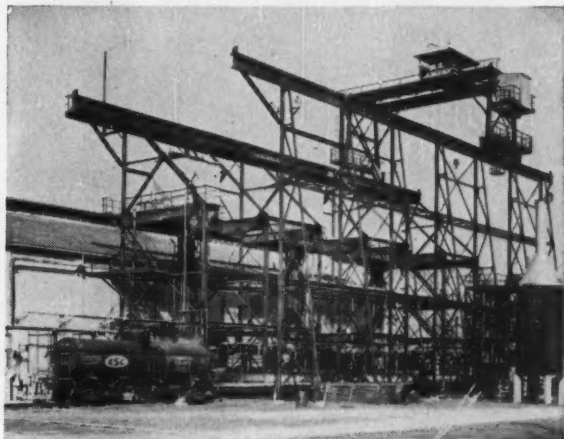
A FLAT HEAD AT EACH END

... requires leak-proof joints. Stud-bolts, $3\frac{3}{4}$ " in diameter, hold these closures in place, and "delta type" gaskets ... self-sealing under pressure ... keep the joints tight. Midvale's close-tolerance, fine-finish machining of seat and gasket make such joints effective for the high pressures involved.



EXPERIENCE

... is necessary to produce this 42'7" vessel ... shaped by equally experienced Midvale workmen who draw upon a half century of the company's experience in forging, and heat treated in closely controlled furnaces to develop physical properties capable of withstanding high working pressures.



THE COMPLETE PICTURE

... of Midvale has been developed through years of experience in making forged steel pressure vessels of many kinds ... converters, reactors, separators, autoclaves. Midvale has men and equipment to make them to your specifications—for corrosion resistance, high temperatures and high pressures. Call Midvale next time. Let our engineers work with you from planning to installation.

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Offices: New York, Chicago, Pittsburgh, Washington, Cleveland, San Francisco

MIDVALE

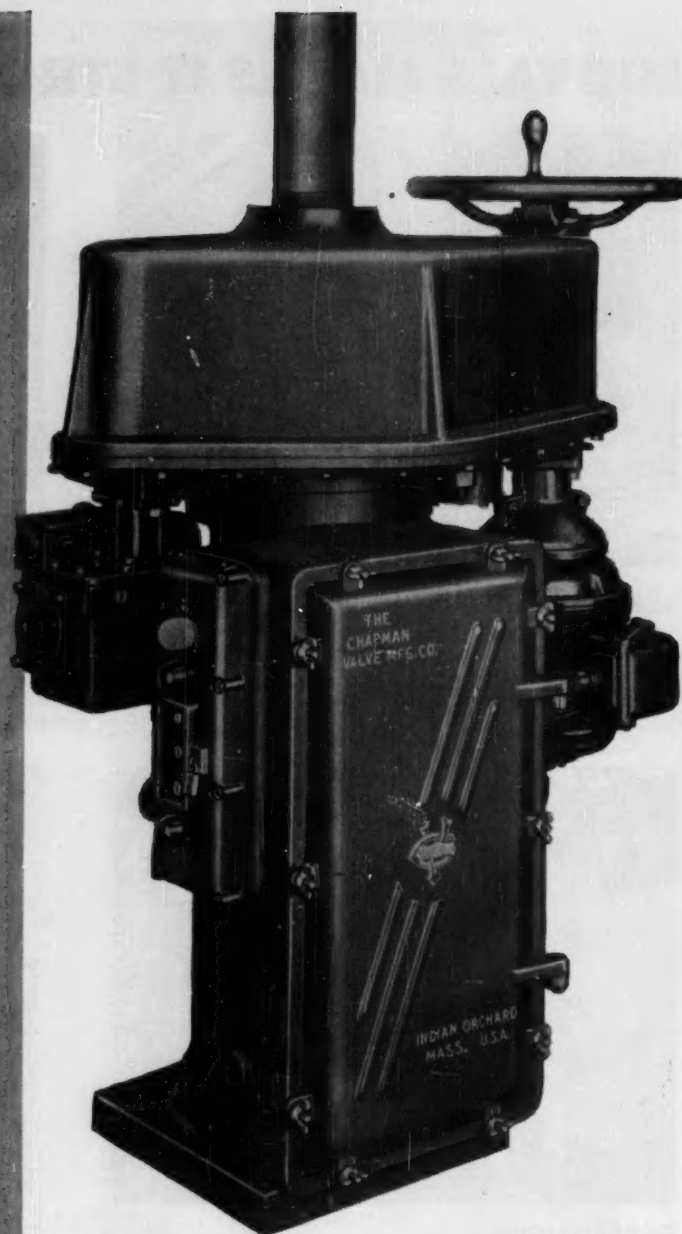
FORGINGS, ROLLS, RINGS, CORROSION AND HEAT RESISTING CASTINGS



**Fewer Parts
Mean
Greater
Dependability**



Floorstand Motor Unit . . . control panel, motor, limit switch and push button station.



Simple, durable mechanism of Chapman's Motor Unit. Handwheel remains stationary during motor operation.

IN CHAPMAN MOTOR UNITS

Chapman's simple and rugged Motor Unit gives accurate, trouble-free control of large valves and sluice gates. It has approximately *half as many parts* as any other unit. Its simplified design, low speed motors and low-ratio, stubtooth gears combine to give positive operation without drift, in *any* position and under all conditions.

Installation is fast and simple. The floorstand unit comes completely wired, ready to connect to leads. Limit switch has micrometer adjustment for exact pre-setting for seating tightness. Motor Units operate smoothly under the most adverse conditions. All units are weather-proof and steam-tight. Write today for *new* Catalog 51.

The Chapman Valve Manufacturing Co.

INDIAN ORCHARD, MASSACHUSETTS

NH_3 Storage SYSTEMS

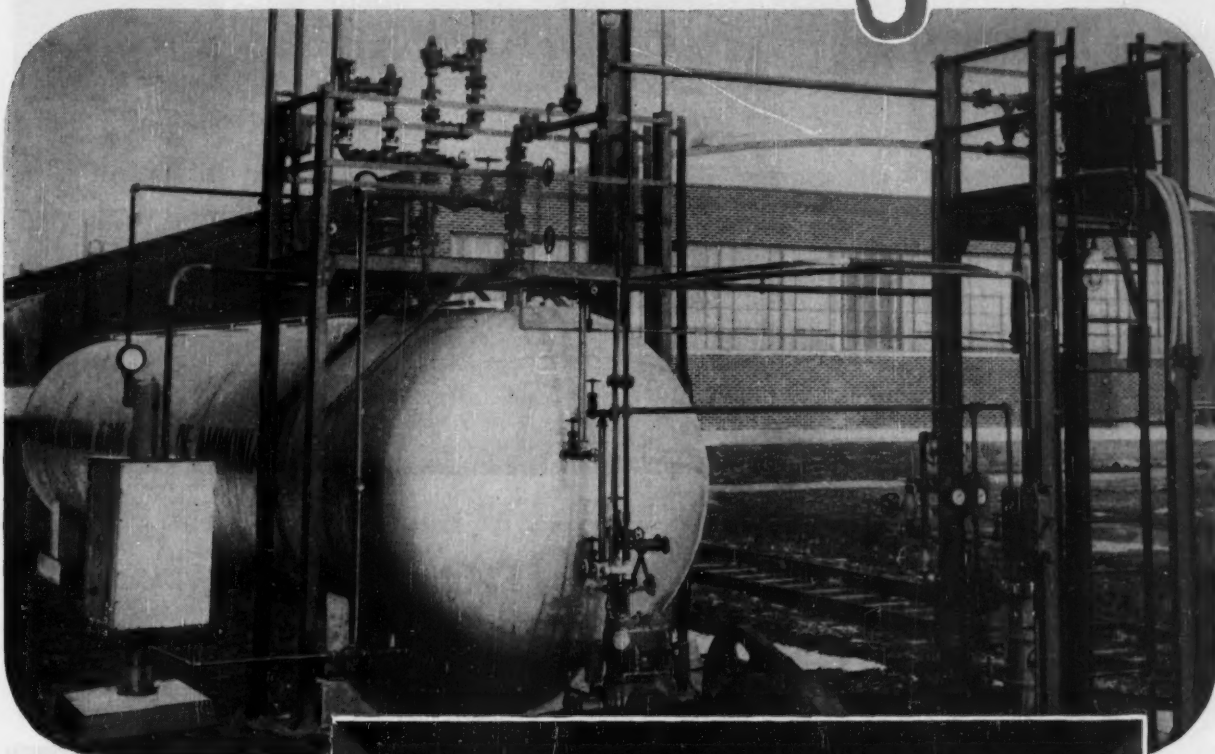


Illustration of typical outdoor installation of 15,000 Gallon Ammonia Storage System.

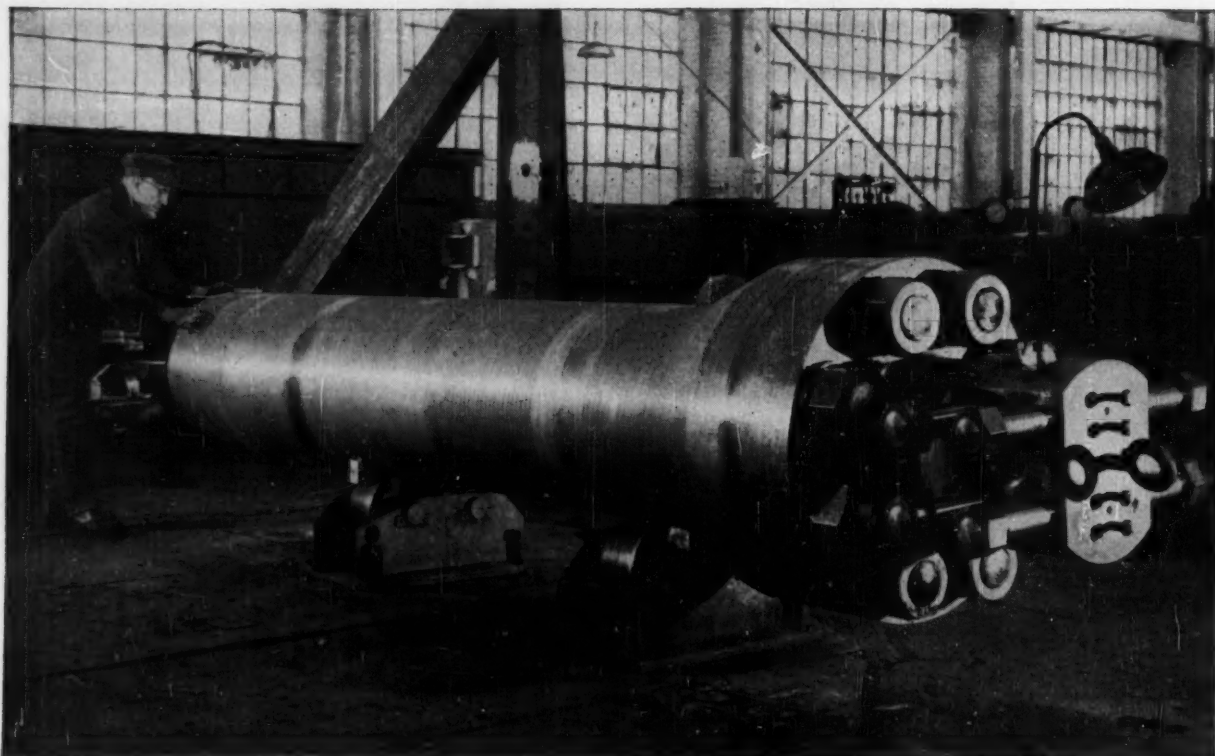
Drever Company offers years of experience in designing and installing unloading and storage facilities for handling anhydrous ammonia.

Systems tailored to meet individual plant requirements.



RED LION ROAD AND PHILMONT AVE.

BETHAYRES, PA.



Separator is One of Six Designed for New Ammonia Plant

This is an 11-ton steel ammonia separator that was recently forged, machined, and assembled at the Bethlehem shops. It is made of chromium-vanadium-molybdenum steel that was thoroughly treated and physical-property-tested. The vessel has an OD of 26 in., an ID of 15 3/4 in., and an overall length of 15 ft 8 in.

The unit is one of six that we built simultaneously for the same customer. All will be used in a plant designed to operate at 12,500 psi.

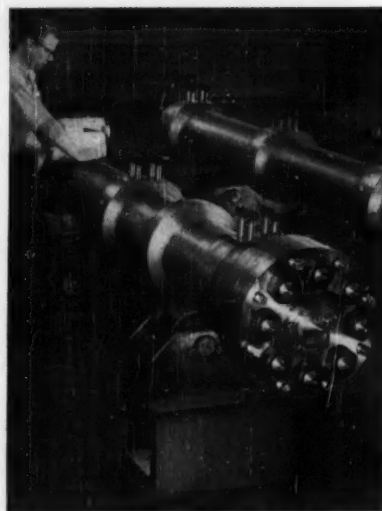
Vessels like this have been a specialty at Bethlehem for many years. Not separators only, but every type of forged pressure vessel, including filters, reactors, converters, auto-

claves, high-pressure accumulators, etc. For the making of such units, Bethlehem has every facility, refinement, and technical device that could ever be required.

When you are planning forged vessels for use in the chemical, rubber, petroleum, fertilizer, food-processing, or allied industries, we'll welcome the opportunity to work with you. Bethlehem engineers will co-operate fully with your own staff, and you can depend on our shops for a workmanlike job on the vessels themselves.

**BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.**

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation



Another type of vessel recently built in the Bethlehem plant. These are pulsation bottles weighing about four tons each. Inside diameter, seven inches.

BETHLEHEM STEEL



At last!

A TRUE VINYL MASTIC!

Complete protection in a single coat—10 mils thick

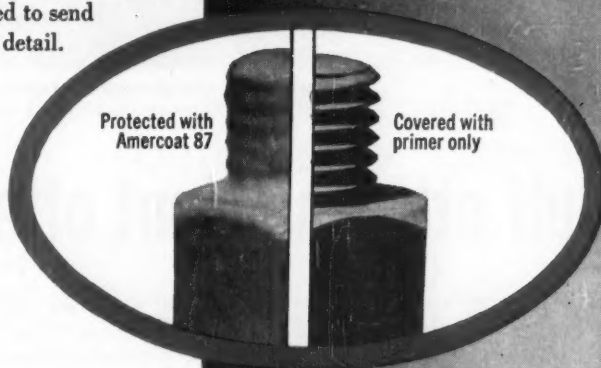
Amercoat No. 87 will cut your maintenance costs because one coat gives you the thickness and protection previously available only through the application of multiple coats.

Amercoat No. 87 is the brand new solution to an old problem, for it combines the time-tested chemical and weather resistance of a vinyl with the extra thickness that was heretofore available only in conventional mastics.

Amercoat No. 87 is easily applied with standard industrial spray equipment. Only one cross-spray coat, over a primed surface, is required for complete protection. Because **Amercoat No. 87** is a true vinyl, it is not limited to black, but is available in a variety of colors.

You can save up to 50% of your labor costs with **Amercoat's** new vinyl mastic **No. 87**. We will be pleased to send you a bulletin describing this new coating in detail.

Notice that the sharp bolt threads, welds and sharp corners are completely protected with one coat of Amercoat No. 87—10 mils thick!

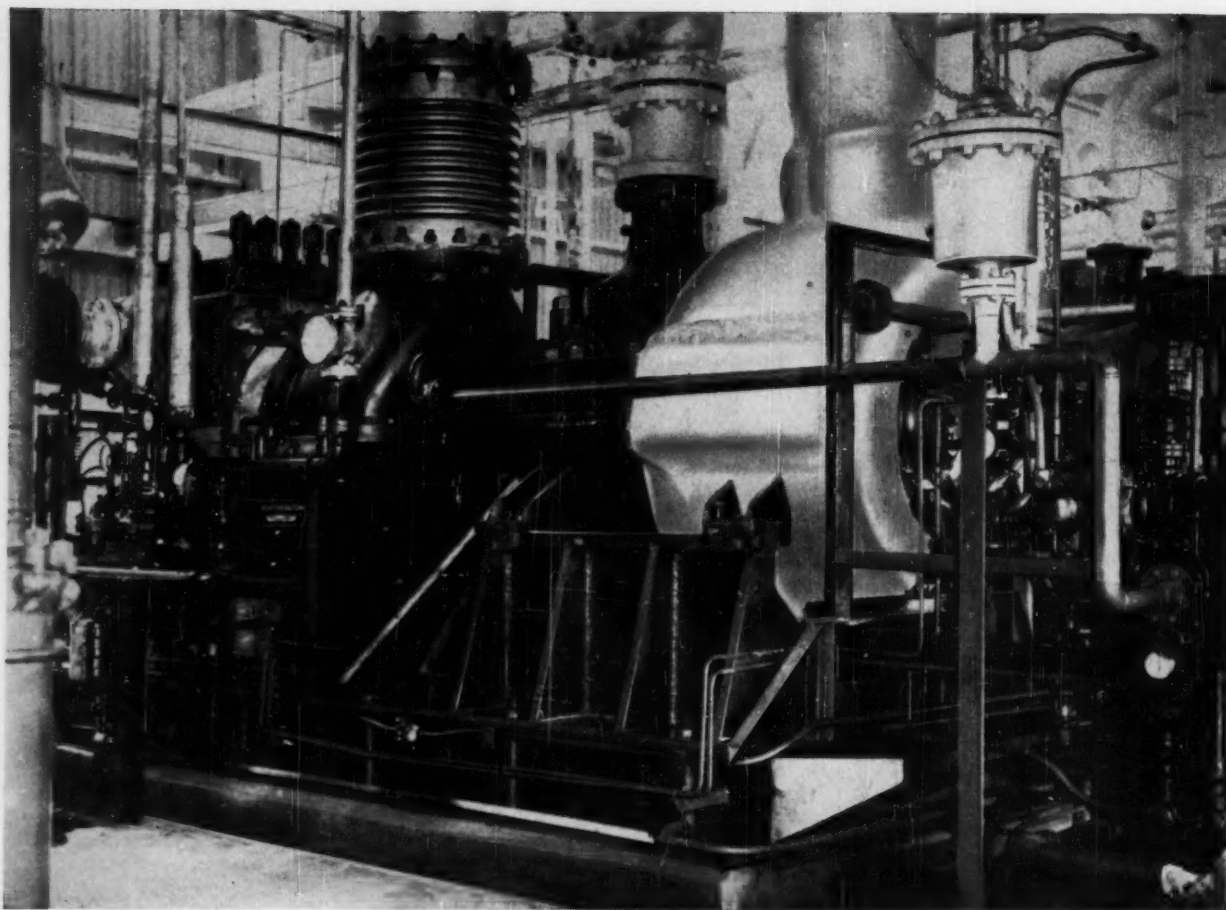


Amercoat

CORPORATION

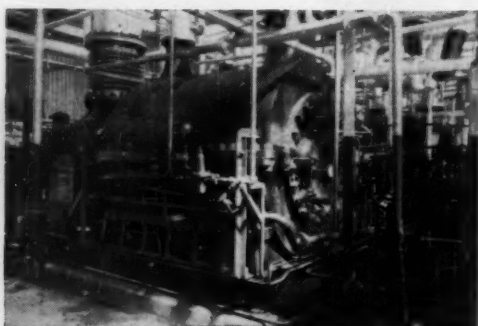
Dept. AE
4809 Firestone Blvd.,
South Gate, California

EVANSTON, ILL. • KENILWORTH, N.J. • JACKSONVILLE, FLA. • HOUSTON, TEX.



WORTHINGTON CENTRIFUGAL REFRIGERATION COMPRESSOR in Gulf's new ethylene plant. Nozzles are for interstage bleed which boost discharge flow to four times initial suction flow.

New Gulf ethylene plant offers "curb service"



HANDLING CHARGE GAS at Gulf plant keeps this Worthington centrifugal compressor busy. Water injection nozzles control temperature, prevent co-polymerization.

"SEE the Worthington Corporation Exhibit in New York City. A lively, informative display of product developments for industry, business and the home. Park Avenue and 41st Street."

Gulf Oil's new 180 million pound-per-year ethylene plant at Port Arthur, Texas, is the first ever designed to deliver its products directly to consumers—some of them 80 miles away—*by pipe line!*

It's also the first to use centrifugal compressors (by Worthington) for charge gas compression, water injection for cooling to prevent co-polymerization and multi-nozzle compressors to accommodate large bleed-in loads.

Three Worthington compressors handle five different charge streams in the process. Two more provide the necessary refrigeration for the process. Power—19,850 hp in all—comes from five Worthington steam turbines and one gas expander.

For over 50 years Worthington has been helping petroleum and chemical processing men with knotty refrigeration problems. Check your Worthington district office about yours—or write Worthington Corporation, Air Conditioning and Refrigeration Div., Section A.5.30, CG Harrison, N. J.

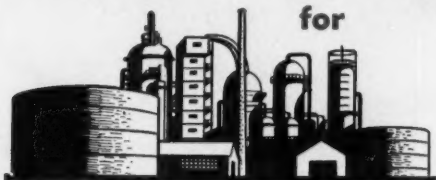
WORTHINGTON



CLIMATE ENGINEERS TO INDUSTRY, BUSINESS AND THE HOME

PLAN YOUR PROCESS PIPING

for



**MAXIMUM SERVICE
and SAFETY with . . .**



**WATSON-STILLMAN
Socket-Welding
FORGED STEEL FITTINGS**



In high pressure steam lines...process liquid and gas piping...hydraulic fluid lines...wherever strong, tough pipe joints are needed, Watson-Stillman Socket-Welding Fittings provide a safety factor against costly piping failures. Drop-forged of high quality steel, they readily resist pressure, heat, corrosion, shock and vibration.

W-S Socket-Welding Fittings are easy to install. Deep sockets support and align the pipe for welding. No need for tack welding or special fixtures. And the outside-the-pipe fillet weld prevents welding 'icicles' inside the pipe.

Watson-Stillman Forged Steel Fittings are available in carbon, stainless and alloy steel for Schedule 40, 80, 160 and XX pipe. Sizes $\frac{1}{8}$ " to 4". A complete line of forged screw-end fittings is also available. Send today for Free catalogs.

Sold Through Leading Distributors



WATSON-STILLMAN FITTINGS DIVISION



H. K. PORTER COMPANY, INC.

Roselle, New Jersey

11



Less heat loss at joints with single-layer Unibestos® Pipe Insulation

Tests prove that Unibestos single-layer pipe insulation actually provides greater protection than other nonfibrous *double-layer* insulations which cost more to install. Unibestos is made of Amosite—the long-fibered African asbestos. These fibers interlock with one another to prevent heat loss at horizontal and longitudinal joints.

While most insulating materials show a pronounced shrinkage at high temperatures, Unibestos has no measurable shrinkage at 1200°F. It will not powder, pulp or wash off, even under heavy moisture conditions, and when dry, Unibestos resumes its original thermal and physical characteristics.

EASY to install . . . easy to remove.

Unibestos can be cut, mitered and handled easily. The fabrication of insulation for tees,

valves, flange covers, etc., is a fast, low-cost operation. Because of its unusual strength and durability Unibestos can be removed and replaced with little or no loss of material.

STANDARD PRODUCTION SIZES

Unibestos Pipe Insulation is regularly made in 3-foot lengths for pipe sizes from ½" through 24", in standard thicknesses through 5". Unibestos Block Insulation is made in 6", 12", 18" or 36" widths and in thicknesses from 1" through 3" in ½" increments.

For complete information, write
for descriptive Bulletin 109C



UNION ASBESTOS & RUBBER COMPANY

1111 West Perry St., Bloomington, Ill.



TWENTY-FOOT LENGTHS of 10" I.D. copper tubes receive final inspection in one of the mills of The American Brass Company. ANACONDA Seamless Drawn Copper Tubes are made up to 26" I.D.

Anaconda Copper Tubes last longer... can actually lower your plant piping costs

Planning a new installation? Want to replace unsatisfactory piping? Then look into the cost and performance advantages of ANACONDA Copper Tubes *first*. Many plants have found them the *least costly* piping material available.

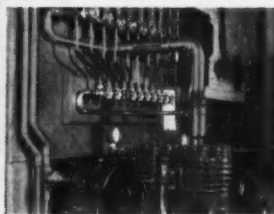
Here's why: ANACONDA Copper Tubes are light. They come in long lengths. Smaller sizes are bent right on the job. All this means big savings on installation costs. And copper tubes can't rust. They resist corrosion and guard against contamination. Smooth interiors mean smoother flow. Pumping costs are often lower.

Here's another advantage. ANACONDA Copper Tubes — connected with solder-type fittings — can be taken down, moved or have new connections cut in faster than with threaded pipe. *You can meet changing plant conditions easily.*

If we can be of assistance in solving a piping problem in your plant please write to: *The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Limited, New Toronto, Ont.*

6446

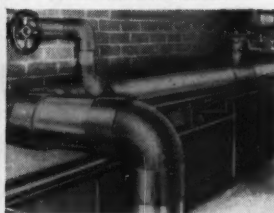
Use Anaconda Copper Tubes for:



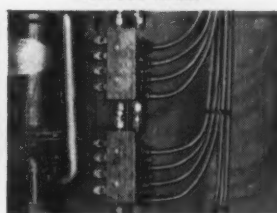
REFRIGERATION AND
AIR CONDITIONING



HOT AND COLD WATER
SUPPLY LINES



INDUSTRIAL
HEATING LINES



AIR, LUBRICATING AND
HYDRAULIC LINES

for copper piping call an

ANACONDA

Distributor



Conveyor belt and
storage bins at
loading docks

Crude Sulphur

for Industrial Use

*from
the
properties
of*

Texas Gulf Sulphur Co.

75 East 45th Street • New York 17, N. Y.

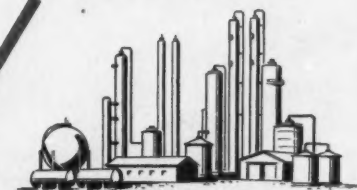
Producing Units

- NEWGULF, TEXAS
- MOSS BLUFF, TEXAS
- SPINDLETOP, TEXAS
- WORLAND, WYOMING

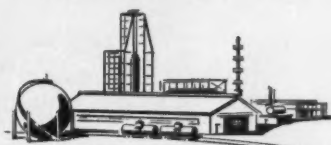
Over 6 Million Tons of **SULFURIC ACID***

produced annually in plants
designed and built by **CHEMICO**

More than 165
Chemico H_2SO_4 plants
are today in operation
all over the world



REFINING INDUSTRY



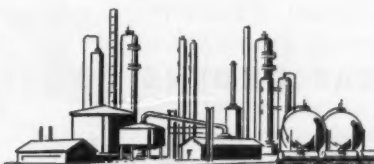
FERTILIZER INDUSTRY



RUBBER INDUSTRY



MINING INDUSTRY



CHEMICAL INDUSTRY



STEEL INDUSTRY



TEXTILE INDUSTRY

***Chemico-designed plants now under construction
will have an additional annual capacity of
500,000 tons of sulfuric acid by the end of 1955.**

CHEMICAL CONSTRUCTION CORPORATION

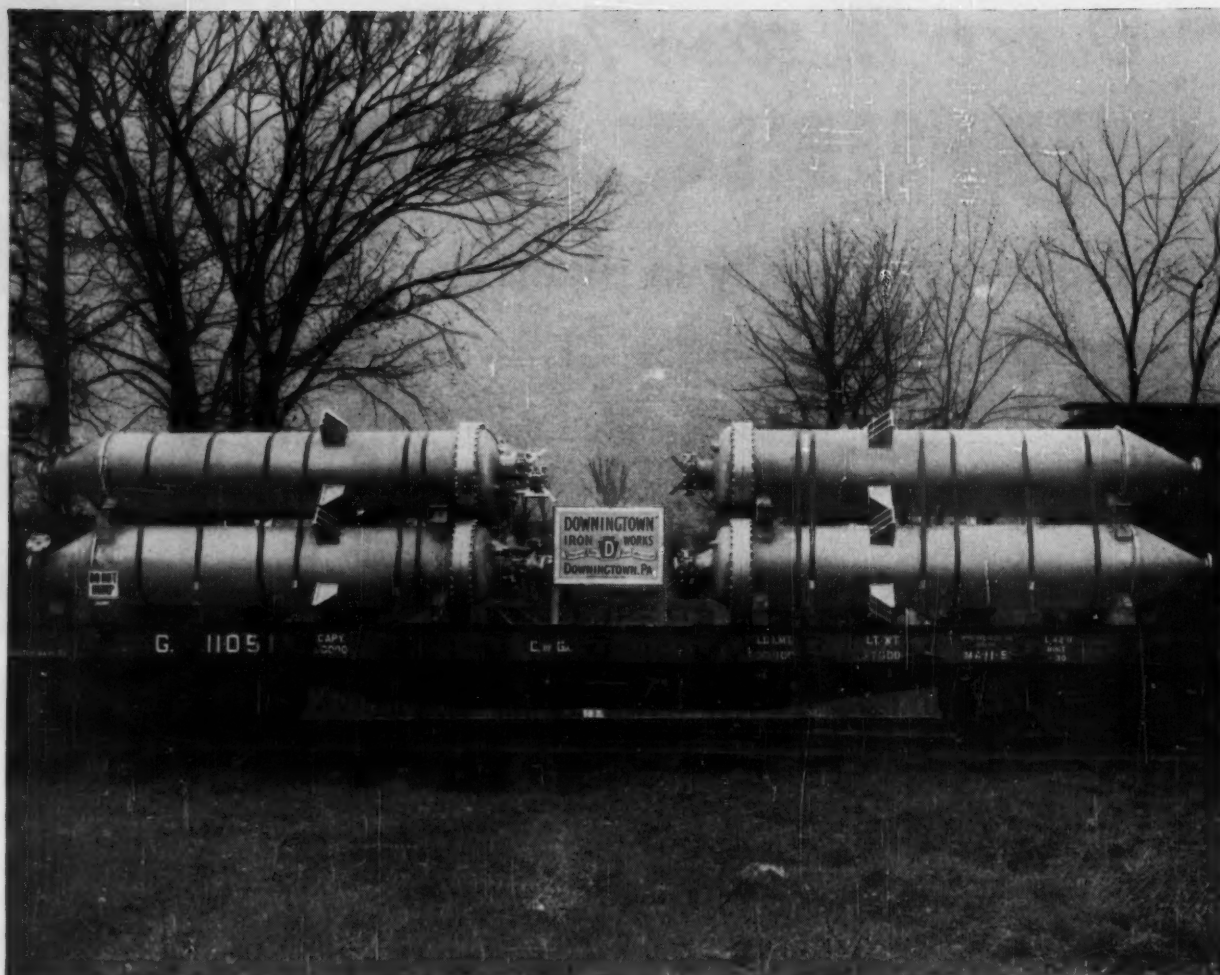
A UNIT OF AMERICAN CYANAMID COMPANY

525 WEST 43RD STREET, NEW YORK 36, NEW YORK

Cable Address: Chemiconst, New York • Technical Representatives: Cyanamid Products Ltd., London
South African Cyanamid (Pty) Ltd., Johannesburg

C H E M I C O





Another carload shipment of 8 process tanks, each 32" O.D. by 13'0" long, fabricated at Downingtown of stainless steel, type 304.

REPEAT ORDERS PROVE

Downingtown Built means Quality Built

These eight stainless steel process tanks form just one of many carload shipments ordered by one customer during the past several years.

Complete satisfaction with workmanship, price and delivery—that's why so many leading chemical, refinery and other process plants turn to Downingtown again and again with repeat orders for their complex plate fabrication work.

They know they can call on our experienced staff of engineers to help work out complex design and construction details. They know they can rely on

Downingtown skill and experience for quality workmanship. They know Downingtown is thoroughly experienced in working and welding many alloys and clad materials, as well as the carbon steels and stainless steels.

Put your plate fabrication problems into experienced hands—at Downingtown Iron Works. Code work a specialty, and authorized insurance company inspection regularly available.

For further information, send for bulletin PF.



Downingtown Iron Works, Inc.

140 Wallace Ave., Downingtown, Pennsylvania

New York Office: 52 Vanderbilt Avenue, New York 17, N. Y.

HEAT EXCHANGERS • TOWERS • PRESSURE VESSELS • STORAGE TANKS • STEEL AND ALLOY PLATE FABRICATION

DIVISION OF: Pressed Steel Tank Company

Manufacturer of Hackney Products • Milwaukee 14, Wisconsin

CONTAINERS AND PRESSURE VESSELS FOR GASES, LIQUIDS AND SOLIDS

COOPER ALLOY

CORPORATION BRIEFS

• Edited by GEORGE BLACK

TURBO MIXING IS VERSATILE

Mixing liquids with liquids, solids or gases is one of the most varied and interesting of the unit processes in chemical engineering. A concise discussion of the problems involved appears in the March issue of COOPER ALLOY "NEWS-CAST." Copies on request.



NEW DISTRIBUTORS ADDED

To keep you up to date with our fast growing distribution facilities for stainless steel valves, fittings and accessories, we list below two well known firms who have recently become authorized distributors.

- Standard Brass & Manufacturing Company
705 Milam Street
Beaumont, Texas
- The Cameron & Barkley Co.
160 Meeting Street
Charleston, South Carolina



PUMPING TILE GLAZE

If you've got a tough abrasive slurry to pump, you'll be interested in the fact that a Vanton Buna N flex-i-liner pump with a natural rubber liner is being successfully used to pump tile glaze from drums to storage tanks. Until the Vanton pump was installed continual pump difficulties were experienced.



COOPER ALLOY
CORPORATION • HILLSIDE, N.J.

3 good reasons for buying COOPER ALLOY stainless steel FITTINGS



- **AVAILABILITY.** Our network of stocking distributors with warehouses and branches in every major industrial city, is backed up by our own extensive stocks in Hillside, New Jersey and Oakland, California to insure delivery when you need it.
- **QUALITY.** As the world's largest and most experienced producer of stainless steel fittings, with the most complete production and inspection facilities, COOPER ALLOY sets the quality standard for the entire industry.
- **COMPLETE LINE.** Whatever your needs . . . whether for screwed, flanged, welding or Quikupl fittings, you will find what you're looking for in the COOPER ALLOY line.



SCREWED. All pipe threads on COOPER ALLOY stainless steel fittings are checked to American Standard Tapered pipe thread gauges, and the use of special tools and equipment assures full threads, accurately gauged and perfectly aligned in all planes.



FLANGED. General dimensions of COOPER ALLOY stainless steel flanged fittings conform to standards set by the American Standards Association for steel flanged fittings . . . or to Manufacturer's Standardization Society specifications for corrosion resistant flanged fittings.



WELDING. COOPER ALLOY stainless steel welding fittings are manufactured in accordance with ASA standards where applicable. They are made of forged or rolled stainless steel; all fittings are of uniform wall thickness and the ends, where wall thickness are greater than .083", are accurately machine tool cut and beveled.

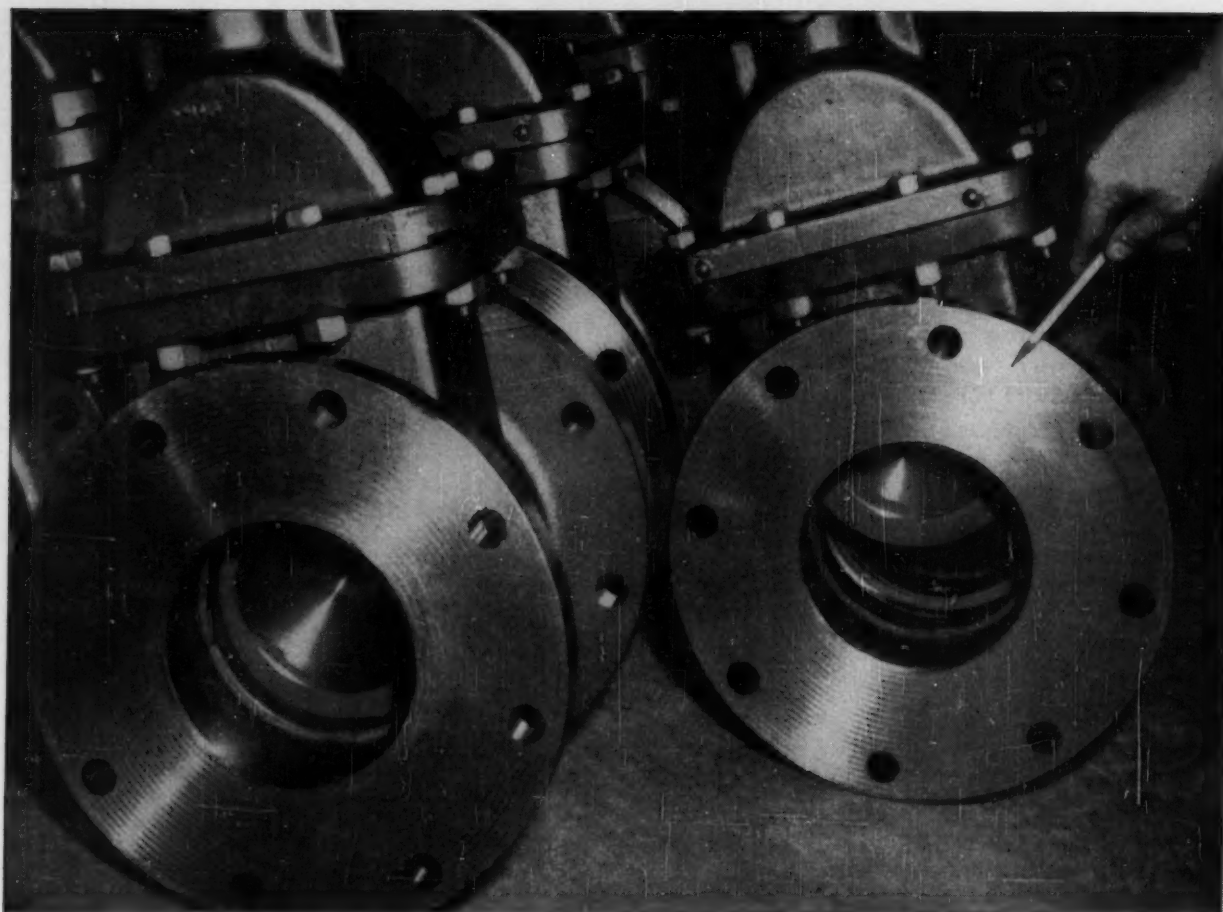


QUIKUPL. These patented stainless steel fittings are designed for quick assembly without threading, welding or flaring. They cut installation or disassembly costs to a minimum, and are ideal for permanent or temporary use.

Write today for copy of Fitting Catalog 52F



COOPER ALLOY
CORPORATION • HILLSIDE, N.J.
Valve and Fitting Division



Corrosion handcuffed in alcohol-acid plant. These valves of "HASTELLOY" high nickel-base alloy assure the desired uninterrupted

operation between inspections. Produced by Hasco Valve and Machine Co., Milwaukee, Wisc.

Nickel-base alloy stops unscheduled shutdowns ... handles 50-60% H₂SO₄ at 200-250°F

Meet some valves that show exceptional corrosion-resistance. They are made of HASTELLOY alloy D, a high nickel-base alloy.

A large oil refinery installed these valves in plants that process and concentrate sulphuric acid, which, in turn, is used for producing isopropyl and ethyl alcohol and ethers.

And here's what this user writes:

"At present, the units are on a four-month scheduled inspection and repair interval. HASTELLOY alloy D fittings are the only ones available that do not require unscheduled shut downs for replacement and accompanying loss of

production between these inspections.

Scores of users report similar savings where equipment is exposed to strong corrosives.

You, too, may obtain excellent results by using one of the series of nickel-base alloys produced and sold under the trade-mark "HASTELLOY" by Haynes Stellite Company, Kokomo, Indiana, a Division of Union Carbide and Carbon Corporation.

Whatever your corrosion difficulty, make use of our wide practical experience. Send details of your problem for our suggestions. Write us today.



THE INTERNATIONAL NICKEL COMPANY, INC. 67 Wall Street
New York 5, N. Y.

WHEN FLUIDS ARE

**TOO ROUGH
FOR METAL!**

**Get the Certain
Protection of
KEL-F® Plastic**

in Valve Linings



Valve Diaphragms



Gaskets



O-Ring Seals



KEL-F Plastic can supply many of the answers to plant equipment corrosion problems. This fluorocarbon plastic is inert to virtually all chemical attack — including mineral acids, oxidizing agents as well as strong caustics.

HIGH COMPRESSIVE STRENGTH

KEL-F Plastic is outstanding for its resiliency and resistance to cold flow. Ring seals and gaskets molded of KEL-F Plastic exhibit a low percentage of deformation under load — retaining seals longer and more effectively.

RESISTANCE TO HEAT AND COLD

KEL-F Plastic has unusually high resistance to temperature extremes — exhibits satisfactory properties over a temperature range of approximately 710° F. (—320° F. to 390° F.)

NON-ADHESIVE

The non-adhesive properties of KEL-F Plastic are advantageous in the handling of viscous fluids, and in maintaining clean, unclogged lines and equipment.

MOLDABILITY

KEL-F Plastic is readily molded — by injection compression or extrusion. Its dimensional stability and low mold shrinkage make it ideally suited to molding with metal. The techniques of molding this fluorocarbon have been fully developed, and perfected. Today, KEL-F Plastic parts and products are produced in volume by molders throughout the country.

Modern processing methods demand plant equipment with greater resistance to corrosion, temperature extremes and higher pressures. The weak links in such equipment are the valves, gaskets and seals. KEL-F Plastic is providing the solution to many of these problems, and producing demonstrable results in reduced downtime and lowered maintenance costs. It is available as a molding compound, or it can be obtained in rods, tubing, sheets and film from a number of suppliers. It is also available in dispersions, suitable for bake-coating on metals and certain non-metals. The full story of KEL-F Polymer should be in your active file. Write us.

® Registered trademark of The M. W. Kellogg Company's fluorocarbon polymers.



THE M. W. KELLOGG COMPANY

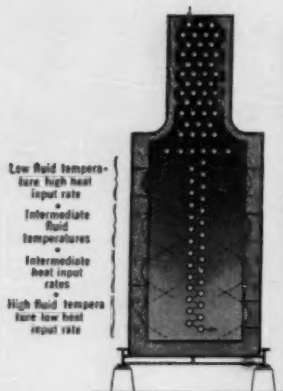
Chemical Manufacturing Division,
P. O. Box 459, Jersey City, N. J.
SUBSIDIARY OF FULLMAN INCORPORATED



FOR ACETONE PYROLYSIS

B. F. Goodrich Chemical NEEDED

Zone Control



A letter from the customer states, "It was decided that a Selsas type furnace would be installed because this type offers the following advantages:

NO HOT SPOTS

It will eliminate local overheating common to many types of industrial furnaces.

UNIFORMITY

It will maintain uniform temperature.

ZONE CONTROL

It offers versatility as to the maintenance of a temperature gradient throughout the furnace.

TUBE LIFE

It offers limited control of the furnace atmosphere to prevent external deterioration of the pyrolysis tube.

NO STACK

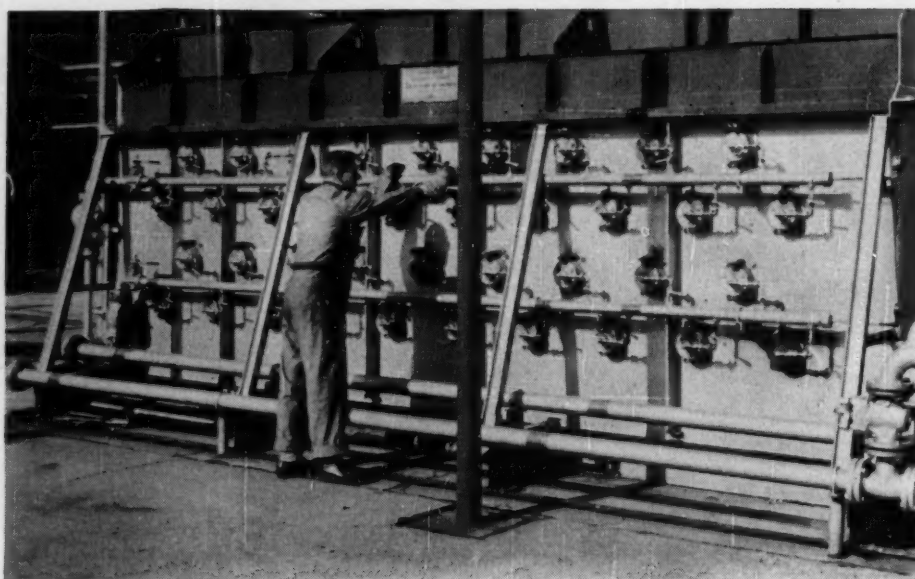
There is no need for a stack on the radiant furnace.

TURNDOWN RATIO

Burners utilizing a radiant heat principle have a 10:1 turndown ratio, as compared to 3 or 4:1 for most industrial burners.

PREFABRICATION

The furnace can be supplied as a package unit.



• The Zone Control possible with Selsas radiant heat was one of the reasons for selection of the Selsas heater by the B. F. Goodrich Chemical Company for its pilot plant at Avon Lake, Ohio, which makes ketene by the pyrolysis of acetone.

Desired temperature "zones", so important in refinery and chemical plant heaters, are created by placing radiant burners (which have no impinging flame) in horizontal rows along the heater walls. Manifolds to the gas burners permit the flow to each row to be adjusted so that a predetermined temperature gradient can be maintained.

For additional information about Selsas Zone Control, write for our new, just-off-the-press bulletin.

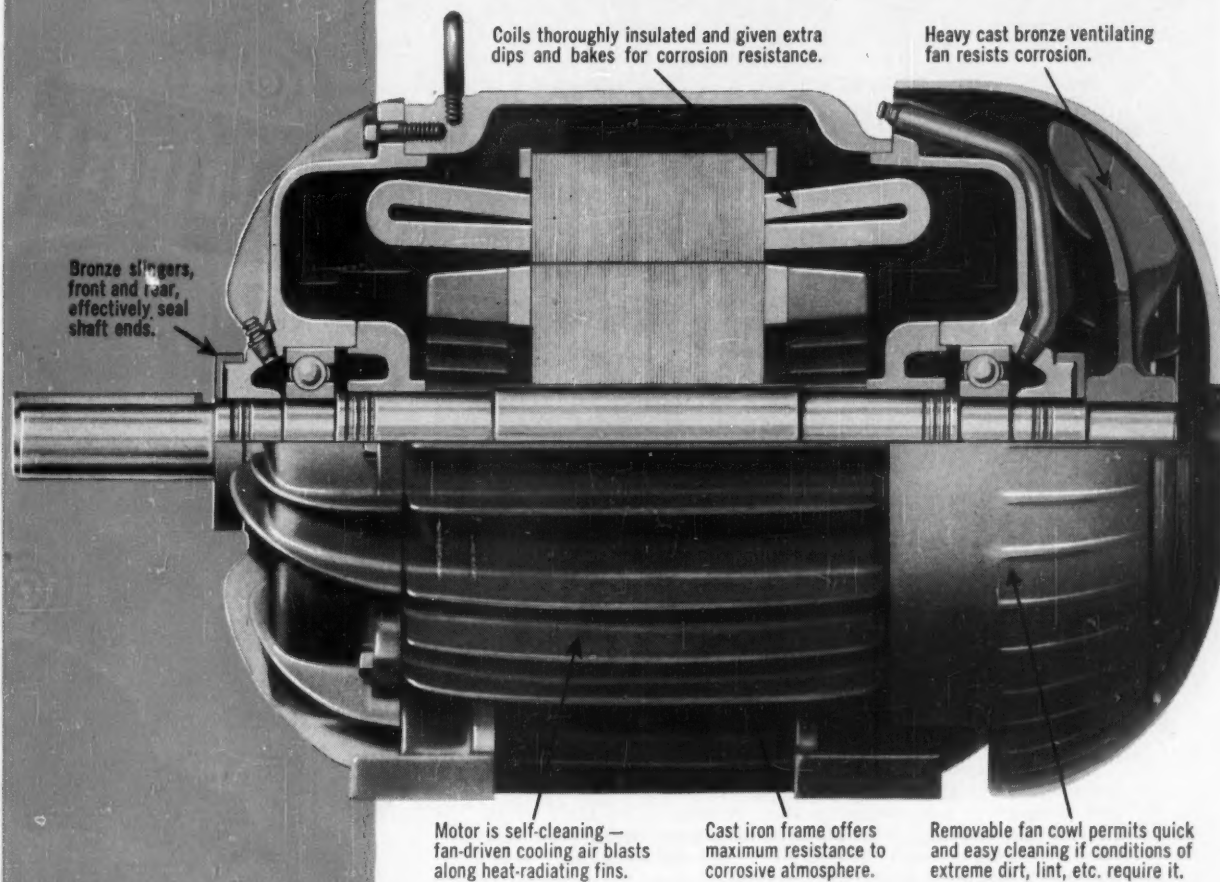
SELAS

FLUID PROCESSING

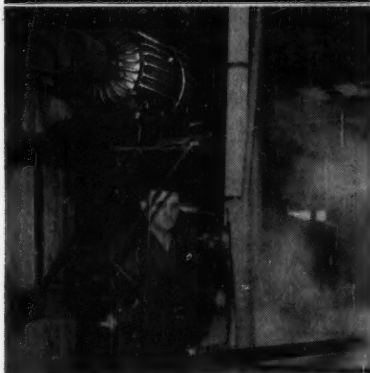
CORPORATION OF AMERICA • PHILADELPHIA 34, PA.



Here's the motor for **TOUGH** process plant service




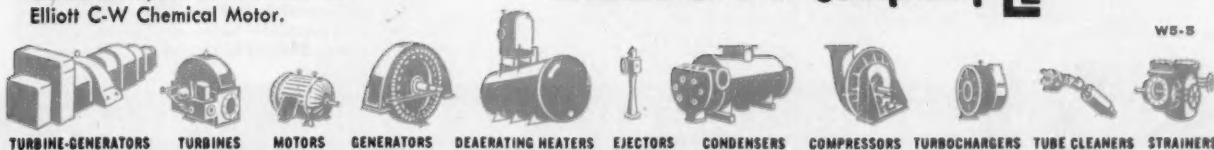
The **ELLIOTT C-W Chemical Motor**



Corrosive vapors don't bother the Elliott C-W Chemical Motor.

• Corrosive fumes and vapors cannot invade this totally-enclosed, fan-cooled motor. It's the famous Elliott C-W *Sealedpower* motor, specially modified to give full protection in rugged process plant service where salt, sulfur, acid and alkali atmospheres are present. And, as with all *Sealedpower* motors, it's cool-running and self-cleaning so that you get top operating efficiency as well as extra protection. The Elliott C-W Chemical Motor is available in any NEMA frame from CFC 225 through CFC 505. For details, ask your local Elliott Field Engineer or write Elliott Company, Crocker-Wheeler Division, Jeannette, Pa.

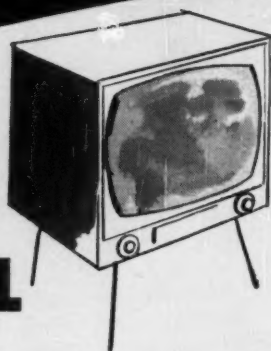
ELLIOTT Company 





50 Years have changed a lot of things!

...including DUST CONTROL



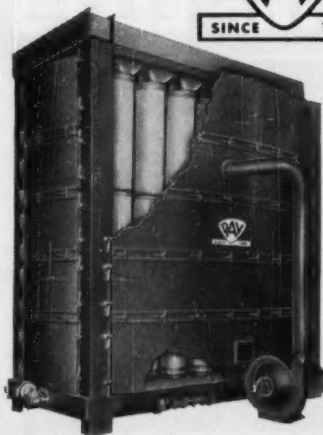
To merely say, "Times Have Changed," regarding the stereoscope of Granddad's day and the TV of today would surely be an understatement. *Times Have Changed* . . . so have industry's methods.

Dust control methods have changed drastically during the past few years and we have played our part in changing them with a new concept, a new design in dust filtering. The DAY High Pressure, Reverse Jet Dust Filter manufactured under DAY and Hersey patents is a real departure from "yesterday's" type filter. The DAY advanced type Dust Filter is progress for industry. It saves valuable plant space because it requires a smaller unit to handle more dust laden air. It saves valuable time because it is pre-assembled at the factory and installation time is cut to a minimum. New facts about modern dust filtering are fully disclosed in a folder which is free to you. Write to DAY for Bulletin 528R.

THE DAY "AC" FILTER, using high pressure, reverse jet cleaning was introduced in 1949. This reverse jet multiple small tube filter brought to industry such advanced features as—square-to-round streamlined dust laden air inlets and multiple screw conveyor discharges. In 1954 DAY introduced the most important feature of reverse jet filters, the DAY Self-Adjusting Cleaning Ring. This cleaning ring makes better contact with the unstable filter medium to provide maxi-

mum cleaning efficiency with minimum filter wear. No other blow ring can clean filter tubes as effectively as the DAY Self-Adjusting Cleaning Ring.

DAY High Pressure Reverse Jet Filtering has been used by leading companies for 5 years. 87% of DAY Filter users have ordered additional DAY Filters. The DAY organization is nation wide and ready to serve you and counsel you on any dust problem. Write for our Bulletin 528R.



Cutaway view of the DAY Dust Filter—available housed or unhoused—for use on either vacuum or pressure. (Licensed by H. J. Hersey, Jr.)

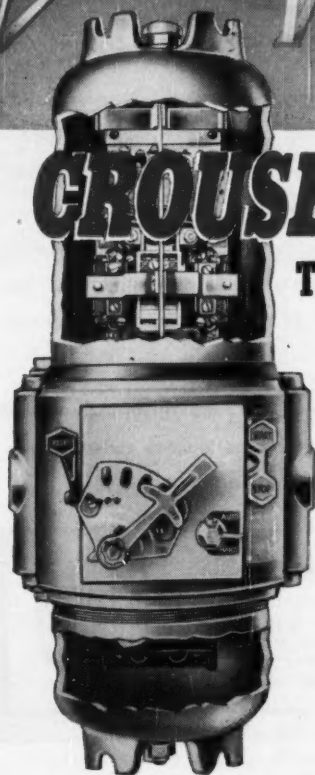
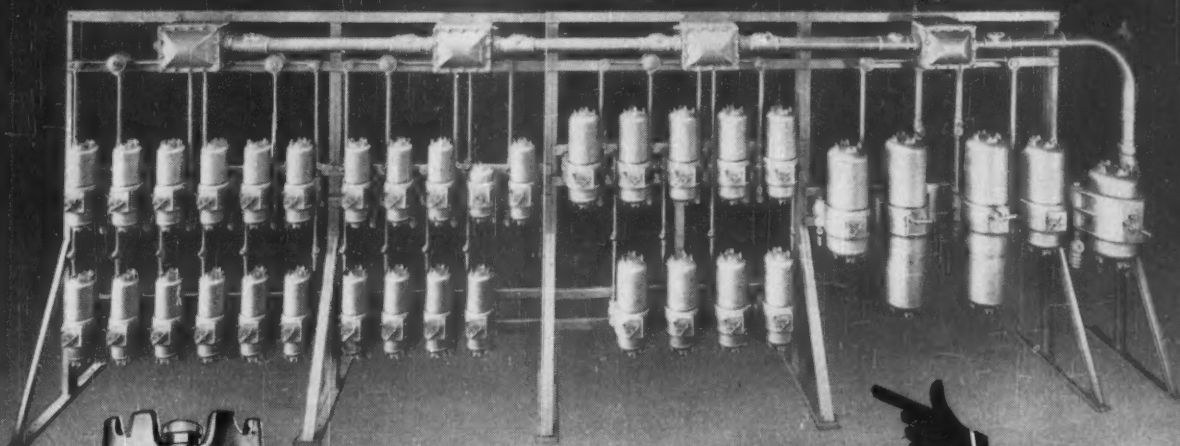
The DAY Company

856 Third Ave. N. E. • Minneapolis, Minnesota
IN CANADA: P.O. Box 70N, Ft. William, Ontario
Branch Plants: Buffalo, Ft. Worth and Toronto, Ontario
Representatives in Principal Cities

STOP

AIR POLLUTION with DAY DUST CONTROL

Need more motor controls
BUT... haven't enough room?



CROUSE-HINDS

Type EPC Explosion-Proof

MOTOR STARTER and CIRCUIT BREAKER

CONDULETS* take up less space!

33 — count them — 33 Crouse-Hinds' combination starters and circuit breakers . . . space for 2 more for later installation . . . plus 2 circuit breakers — all in 28' x 10' of space! Conventional single-tiered installation would have required 20 ft. — longer rack and 4 more junction boxes.

As in the installation shown above, a given area will hold *more* Crouse-Hinds' motor controls than any other make. You save money on the construction of steel mounting racks — fill your needs without occupying additional premium floor space.

- Explosion-proof, dust-tight, weather-resistant.
- Light-weight cast aluminum for easy installation without lifting equipment.
- Flame-tight threaded joints throughout.
- Seven conduit entrances simplify installation.
- Built-in push button stations and built-in selector switch available.
- Starter sizes 0 to 5. Circuit breakers 50 to 600-amp. frame sizes.

Let Crouse-Hinds help you solve your space problems.
 Engineering assistance available without obligation.

*CONDULETS are made only by CROUSE-HINDS



A **NATIONWIDE
 DISTRIBUTION**
 exclusively through
**ELECTRICAL
 DISTRIBUTORS**

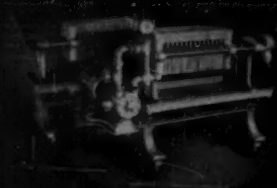
CROUSE-HINDS COMPANY

SYRACUSE 1, N. Y.

OFFICES: Birmingham, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Houston, Indian
 apolis, Kansas City, Los Angeles, Memphis, Milwaukee, New Orleans, New York, Philadelphia, Pittsburgh,
 Portland, Ore., St. Louis, St. Paul, San Francisco, Seattle, Tulsa, Washington, RESIDENT REPRESENTATIVES: Albany,
 Atlanta, Baltimore, Baton Rouge, Charlotte, Chattanooga, Corpus Christi, Reading, Pa., Richmond, Va., Shreveport,
 Crouse-Hinds Company of Canada, Ltd. Toronto, Ont.

CONDULETS • FLOODLIGHTS • TRAFFIC SIGNALS • AIRPORT LIGHTING

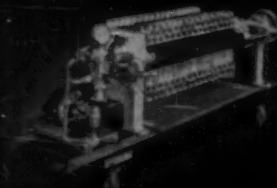
For more facts circle 509 on Reply Card



Handles any filterable mixture



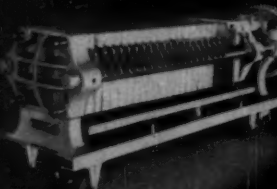
Low, medium, or high pressure



Takes hot vapors without vaporizing



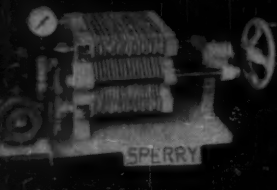
Uses any simple filter cloth



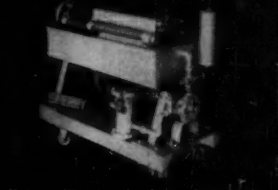
Produces maximum clarity



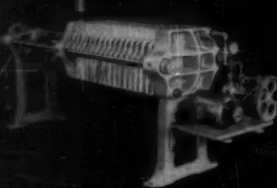
Makes the driest cakes



Leak proof construction



Delivers filtrate higher than filter



Can separate emulsions



Can deliver cake in slab form



Low first cost • Low upkeep • Low depreciation • Low installation cost



THOUSANDS of SPERRY FILTER PRESSES

serving

HUNDREDS

of industries . . .

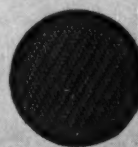
built to **ONE**
standard of quality!

In every processing industry — wherever solids are to be removed from any mixture — Sperry Filter Presses are on the job . . . helping to produce products of maximum clarity at low cost. Living proof of the detailed research, custom engineering and standard of quality that has kept Sperry first in filtration for three generations.

If you can utilize the significant knowledge gained from this vast experience — consult Sperry for filtration, today!

SPERRY FILTER BASES

All types . . . all sizes. Plain or punched to your specifications. Besides cotton and paper, bases are furnished in wool, synthetics, glass, and woven metals.



NEW SPERRY Catalog & Specification Book NOW AVAILABLE!

Written more as a text and reference manual, this "encyclopedia of filtration data" improves your understanding of a vital process; aids in the selection of the proper equipment for your specific filtration requirements. Write for your free copy of this valuable booklet — today!



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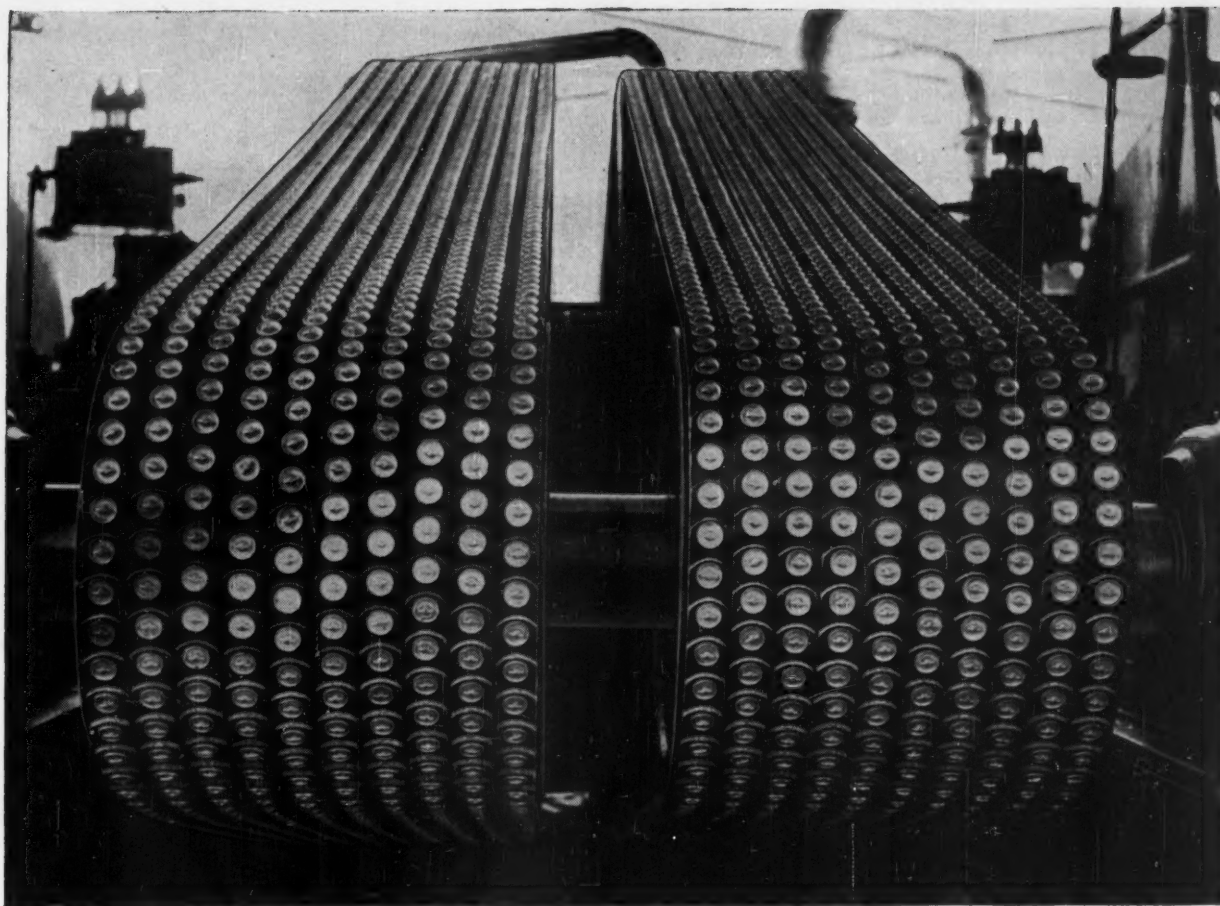
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Veelos TD and TE v-belt *lasts longer*. High-tensile strength links plus unusual stud, cup-washer and T-screw design give added strength and maximum flexibility for cooler, smoother running.

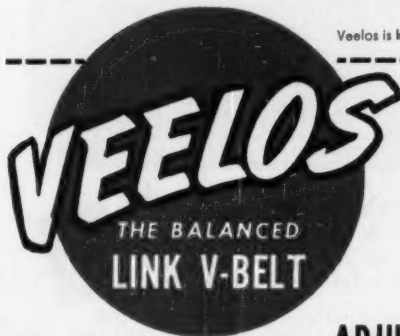
Only Veelos TD and TE adjustable v-belt provides *balanced, vibrationless, full power*

delivery because this v-belt alone is absolutely uniform throughout its entire length.

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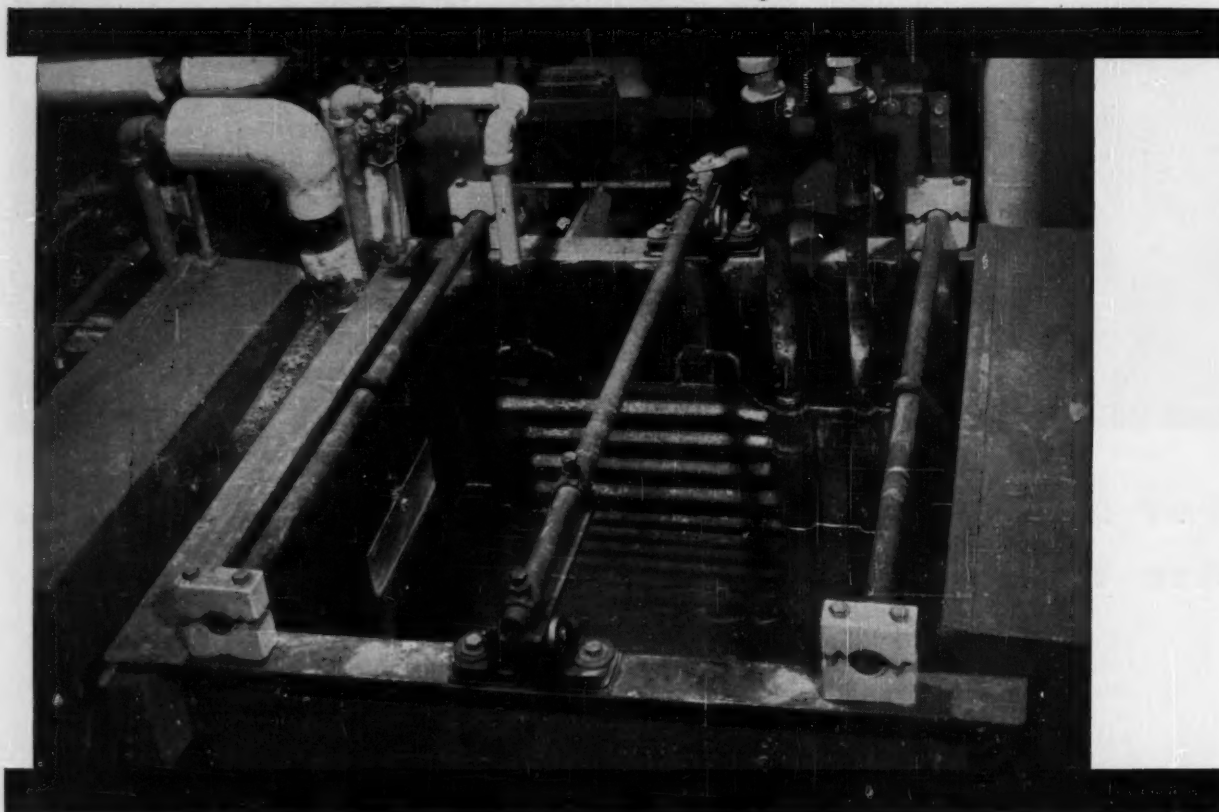
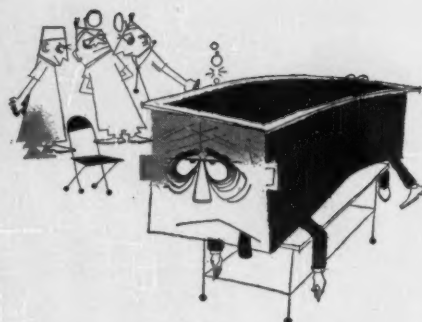
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ADJUSTABLE TO ANY LENGTH • ADAPTABLE TO ANY DRIVE

**new Wyandotte Research Laboratory
uses PLATECOILS®
to prevent coil-itis ***

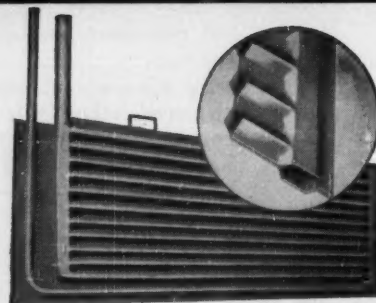
One of the finest technical laboratories in the country is the new Research Laboratory of Wyandotte Chemicals Corporation, Wyandotte, Michigan. A key feature of this laboratory is a series of 100-gallon plating and cleaning tanks made of various materials, such as rubber and plastic, which resist the actions of different types of chemicals. Individual tanks can be heated from room temperature to 212 degrees in less than an hour, by the Platecoil heat transfer units in the tanks. "We find Platecoil to be ideal because of their easy-to-clean surfaces and standardized performance," reports A. W. Liger, Supervisor of Industrial Research.



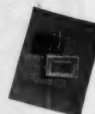
PLATECOILS replace pipe coils
for 50% of the cost

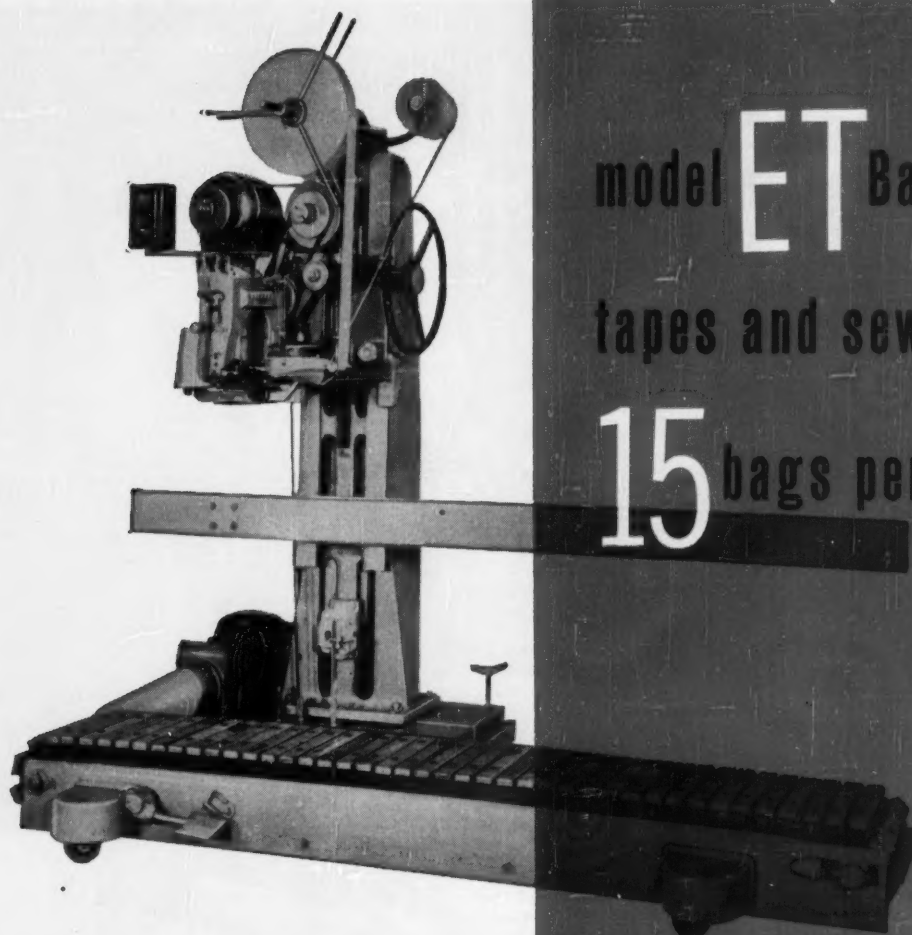
* Coil-itis is the constant doctoring of wet processing tanks for pipe coil troubles. It can be cured easily by replacing pipe coils with Platecoils. Immediately, you will notice the difference as Platecoils put new life and profits into your heat transfer processes. They heat or cool 50% faster and take 50% less space in the tank. They save as much as 50% in initial cost and 50% in maintenance costs in addition to overcoming the limitations and operating difficulties of old fashioned and outmoded pipe coils.

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Bulletin P61 shows how Platecoils are replacing pipe coils at a savings throughout industry. Send today for your copy.





model **ET** Bagpaker®

tapes and sews

15 bags per minute

**TAKE ADVANTAGE OF THESE 5
MODEL ET BAGPAKER FEATURES:**

- One operator finishes 15 bags a minute when filled bags are delivered continuously to the conveyor
- Adjusts to bags from 25 to 100 lb. capacity
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Here's the perfect teammate for your present filling and weighing equipment—the most efficient way to get better protection and faster packaging at the lowest possible cost.

Here's how the Model ET Bagpaker works: One operator receives bags from your weighing and filling machine. In four seconds or less the Bagpaker has applied creped "kraft" sealing tape over the bag end, sewn a reinforced "cushion stitch" through both tape and bag, and trimmed the tape. You can't beat that for efficiency and speed.

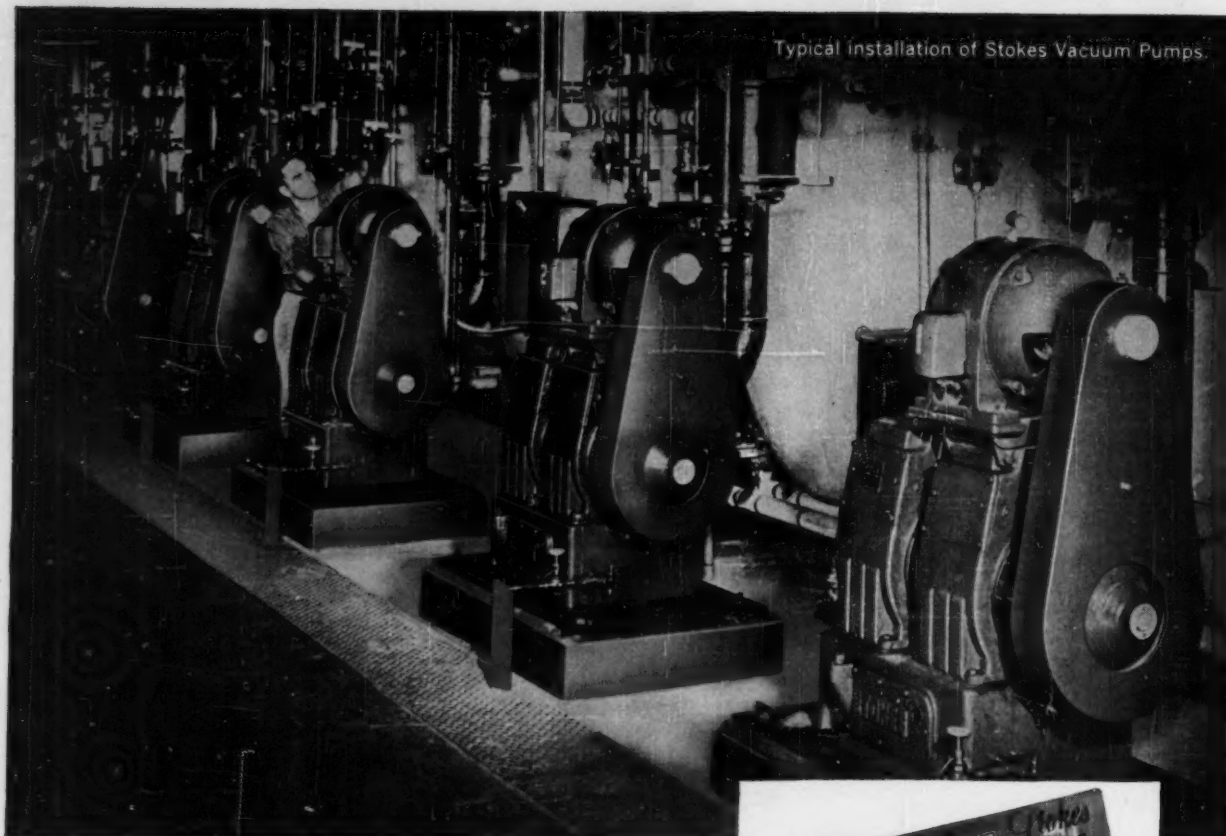
Booklet ET gives you complete details and dimensional drawings, shows you how perfectly Model ET fits into your existing filling set-up. There's no obligation—just write to: E-16

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Stokes Microvac Pumps... basic to Vacuum Processing

High volumetric and mechanical efficiency make these famous pumps economical and reliable units in any vacuum system.

Capacities of Stokes Microvac Pumps run from 15 to 500 cfm . . . pressures to 10 microns absolute. Power consumption is low and the top-mounted motor contributes to compact design requiring minimum floor space.

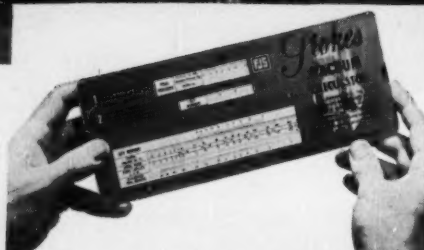
Lubrication of the four moving parts (including the exhaust valve of corrosion-resistant Teflon) is fully automatic. There are no stuffing-boxes or grease-fittings, and no packing.

Parts are precision-finished, standard and interchangeable. Freedom from wear assures years of trouble-proof service.

Stokes is the only manufacturer of equipment for complete vacuum systems, including Microvac mechanical pumps, Ring-Jet Diffusion and Booster pumps, McLeod Gages and Vacuum Valves.

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Send for new Vacuum Calculator for rapid slide-rule calculations. Includes standard ABCD log scale. Also send for Catalog 700, "Stokes Microvac Pumps for High Vacuum," with copious reference material.



Send for copy of a new hand-book "How to Care for Your Vacuum Pump." (Bulletin No. 755). Contains many valuable suggestions about installation, starting, servicing, trouble-shooting, and helpful "Do's" and "Don'ts" on vacuum pumps and systems.

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FRONT WHEEL DRIVE

MODEL HA— Completely new model — twice the digging, carrying and lifting capacity. Exclusive 40 degree bucket break-out at ground level. Digs, carries, dumps and spreads bulk materials — indoors and outdoors. Unloads box cars of bulk materials. 18 cu. ft. bucket capacity.

MODEL HAH — a larger front-wheel-drive model with 24 cu. ft. bucket capacity. Large, 12"00 x 24 inch pneumatic tires on drive wheels give tremendous traction on or off pavement. Rear-wheel power steer insures easy operation and fast maneuvering in close-quarters.



REAR WHEEL DRIVE

MODEL HFC— This "PAYLOADER" with 1 cu. yd. bucket capacity is a popular, well-proven model especially for outdoor use. Rear-wheel-drive enables it to dig and grade as well as load trucks, carry and stockpile. Travel speeds up to 19 m.p.h.

MODEL HFHC— This extra high-lift "PAYLOADER" can dump its loads over bin edges up to 11½ feet high. Especially popular for loading and handling coal and other light materials into high trucks and wherever high lift and long reach are desirable.



FOUR WHEEL DRIVE

MODEL HM— This pioneer 4-wheel-drive tractor-shovel with 2 cu. yd. bucket is the largest in the "PAYLOADER" line, with an enviable reputation in construction, raw materials and manufacturing industries. Rear-wheel power-steer makes it maneuverable and easy to handle.

MODEL HR — Provides the many advantages of 4-wheel-drive in a smaller machine. This 1 1/3 cu. yd. machine has proven as popular as the bigger HM and has the same features, including 4 speeds both forward and reverse and rear wheel power steer.



MODEL TM — A big, 4-wheel-drive tractor with 15,000 lbs. drawbar pull. Has effective traction to work on pavement, snow, sand and mud. Used for switching and spotting cars—walks easily across tracks. Can be equipped with railroad couplers, air brake control, etc.

MODEL TU-90 — Another 4-wheel-drive tractor with power steer. Pushes or pulls in either direction. Only 5 feet high; 12 feet long. Will handle large aircraft easily — has 9,000 lbs. drawbar pull.

MODEL TC-60 — A powerful, compact tractor with 6,000 lbs. drawbar pull, yet less than 10 feet long. Rear wheel drive on dual tires; front-wheel power-steer; speeds up to 17 mph.

Full-reversing transmissions plus torque converter drive feature all these famous "PAYLOADER" tractor-shovels and tractors — give them maneuvering speed, ease of control and a wide choice of operating ranges.

Each "PAYLOADER" is a proven unit, made by the tractor-shovel pioneer that has built more wheeled tractor-shovels than all others combined. And "PAYLOADER" units are sold by an experienced, well-established Distributor organization having complete parts and service facilities that protect your "PAYLOADER" investment.

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Please send information on the complete line of "PAYLOADER" tractor-shovels and tractors.

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Title _____

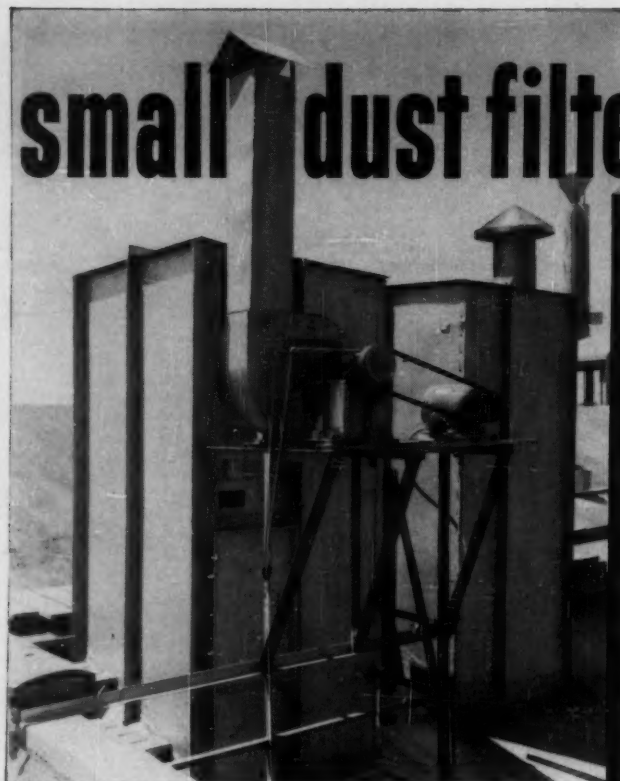
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small dust filters do BIG JOB!



Two small Dracco Multi-Bag Filters are mounted on roof of Niagara Chemical plant to control and recover costly toxic chemical dusts produced in insecticide manufacturing operations.

At its Middleport (New York) plant, the Niagara Chemical Division of the Food Machinery and Chemical Corporation gets big results from its battery of small Dracco Multi-Bag Filters. By recovering toxic dusts, these filters produce better plant safety plus important cost savings.

Mounted on the roof to save space, the Dracco Filters trap toxic organic chemical dusts such as Parathion, DDT, and Benzene Hexachloride created during production of insecticide and fungicide dusting powders.

Primary purpose of the dust collection system is to protect workers' safety since the dusts are a distinct health hazard. The hazardous dusts are captured at their source, then carried away in an enclosed system *before* they can harm personnel.

Since the dusts are high-cost chemicals, their recovery by the Dracco units and return to process represents a sizable cost saving for Niagara Chemical.

Dracco makes Multi-Bag Filters in sizes to do any dust collection job, each specially engineered for its specific application. All operate at better than 99½% efficiency.

To get big results in handling your dust problems, contact Dracco for the best in engineered dust control.

DRACCO CORPORATION
4040 East 116th Street • Cleveland 5, Ohio

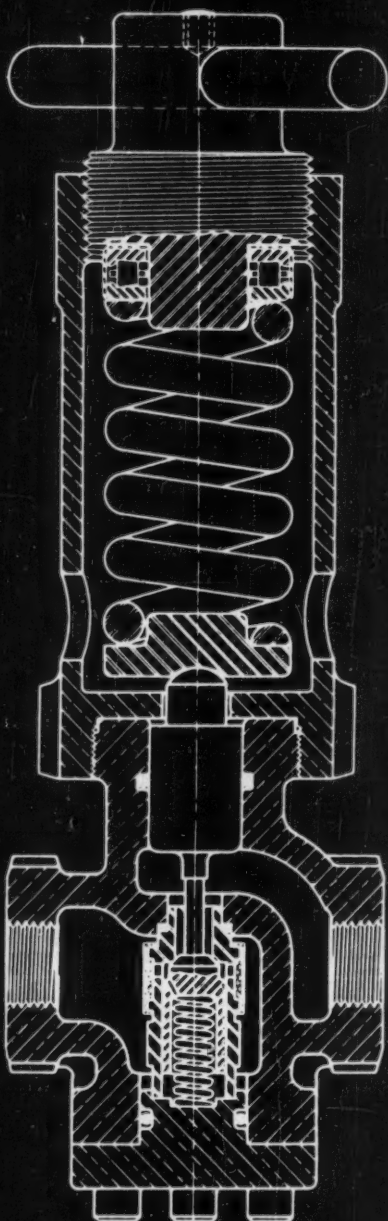


By using a number of small filters instead of a large centralized dust collection system, Niagara Chemical secures (1) operational flexibility and (2) separate collection of individual chemical dusts which facilitates reuse of these materials.

DRACCO

Performance Proved
Airstream CONVEYORS • DUST CONTROL EQUIPMENT

A RUGGED, DEPENDABLE VALVE FOR HIGH-PRESSURE APPLICATIONS



CASH STANDARD

TYPE 345

Pressure Reducing and Regulating Valve

Designed for hydraulic presses, hydraulic systems, die-mold apparatus and high pressure pneumatic systems (oxygen, nitrogen, hydrogen).

- For use on air, water, oil and various gases (not for steam)
- Inlet pressures: 500 to 4000 psig
- Delivery pressures: 400 to 3000 psig
- Bronze or steel construction
- Piston-operated with O-ring seals
- T-bar adjusting screw combined with roller thrust bearing for ease of adjustment
- Internal strainer screen
- Corrosion resistant
- Operating fluid around renewal unit results in equal expansion and contraction of internal mechanism, precludes sticking or seizing
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- Renewable inner units of nitrided or stainless steel. For severe conditions, stellite facing is available
- Screwed ends, sizes $\frac{1}{2}$ " , $\frac{3}{4}$ " , 1"



CASH



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PRESSURE, HYDRAULIC, TEMPERATURE, PROCESS AND COMBUSTION CONTROLS

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dries petroleum catalyst with a

STANDARD HERSEY
ROTARY DRYER



Intermediate Feed System makes Combination Dryer

The patented STANDARD-HERSEY intermediate-feed system makes the dryer used by Davison Chemical Corporation a combination flash and rotary dryer. This combination retains the most desirable characteristics of each.

Here is another example of the engineering skill developed by the 52 year old Standard Steel

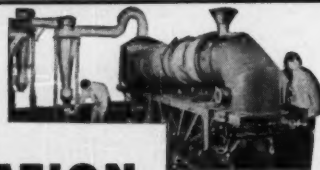
Corporation. Thousands of successful dryer applications such as this give STANDARD-HERSEY an unsurpassed background to draw on in solving your drying problems. More than 30 different dryer types are available to fit any drying requirement. Contact STANDARD-HERSEY for the most profitable, most productive solution to your drying needs.

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Learn how STANDARD-HERSEY
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GUESSWORK OUT OF DRYING
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play an important part in solving your
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CHEMICAL ENGINEERING

PROPERTY AND APPLICATION DATA ON THESE
VERSATILE ENGINEERING MATERIALS: "ZYTEL,"
"ALATHON," "TEFLON," "LUCITE."

NEWS

NO. 4

1955

Unbreakable Laboratory Ware



Users can expect longer service life from these funnels and beakers. Because they're molded of tough Du Pont "Alathon" polyethylene resin, equipment breakage is eliminated. These units are lighter in weight than glass. "Alathon" has outstanding resistance to chemicals. A full line of laboratory items—including a faster-filtering funnel and cylinders with molded-in graduations—is expected to be on the market soon. (Molded by Pioneer Plastics, Dayton, Ohio.)

Cup of Molded "Zytel"* Used for Testing Soils

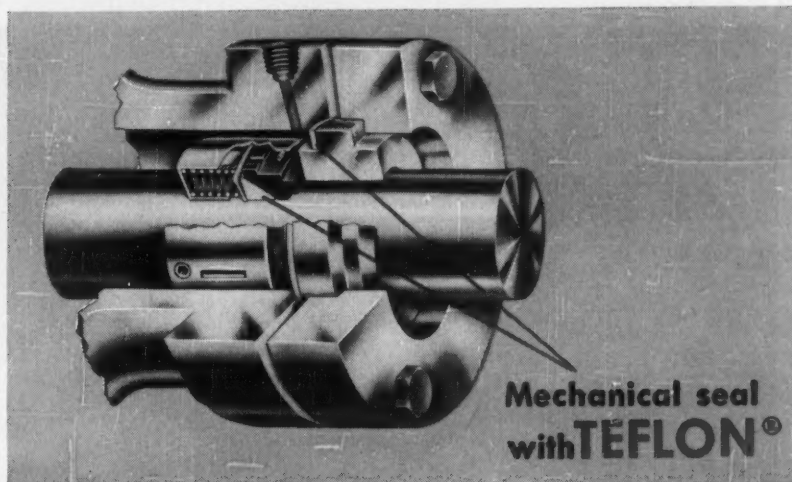


Tough, corrosion-resistant "Zytel" nylon resin makes an ideal material for this cup, used for measuring soil fertility.

Onestep in measuring soils for fertilizer content is to mix the soil with distilled or rain water until the saturation point is reached. Then this saturated soil is transferred to a cup and struck off level with the top of the cup.

This soil cup takes hard treatment. To eliminate breakage and at the same time market an attractive unit, the manufacturer has molded the cup of "Zytel" nylon resin. The cup of "Zytel" is molded around stainless-steel electrodes, on either side of the cup.

Du Pont "Zytel" resists corrosion by common acids and alkalis, making it useful for many chemical applications. Use the coupon on this page for complete property information. (Cup is molded for Industrial Instruments, Inc., Cedar Grove, N. J. by Industrial Devices, Inc., Edgewater, New York.)



**Mechanical seal
with TEFLON®**

Mechanical seal, used on all types of revolving shafts, has a flexible wedge ring and a sealing ring made from chemically inert Du Pont

"Teflon" tetrafluoroethylene resin. (This seal is manufactured by the Crane Packing Company, of Chicago, Illinois.)

Chemically Inert TEFLON® Has a Working Temperature Range From -405°F. to 500°F.

Versatile Crane shaft seals are particularly useful for pumps, agitators and mixers where severe service conditions exist. This seal is equipped with a wedge ring and a sealing ring of Du Pont "Teflon"—an engineering material that offers industry outstanding chemical inertness. In this application, "Teflon" handles the most difficult corrosive liquids and gases at pressures to 150 psi in regular seal construction, and 750 psi with balanced seal construction, the manufacturer reports. Its working

temperature range extends from -450°F. to 500°F. The flexibility and surface characteristics of "Teflon" meet all the requirements of mechanical seal surface.

Perhaps you have a heat or corrosion problem that's currently giving you trouble. Then why not investigate the remarkable properties of Du Pont "Teflon"?

Complete property and test data will be sent to you on request. Simply clip and mail the coupon below.

NEED MORE INFORMATION?

CLIP THE COUPON for additional data on the properties and applications of these Du Pont engineering materials.

*"Teflon," "Alathon" and "Lucite" are registered trademarks of E. I. du Pont de Nemours & Co. (Inc.).
†"Zytel" is the new trademark for Du Pont nylon resin.

E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department
Room 255, Du Pont Building, Wilmington 98, Delaware
In Canada: Du Pont Company of Canada Limited,
P.O. Box 660, Montreal, Quebec.

Please send me more information on the Du Pont engineering materials checked: ☐ "Teflon"* tetrafluoroethylene resin; ☐ "Alathon"* polyethylene resin; ☐ "Zytel"† nylon resin; ☐ "Lucite"* acrylic resin. I am interested in evaluating these materials for_____

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Chase® Antimonial Admiralty resists dezincification—adds years to heat exchanger tube life!

Chase Antimonial Admiralty Heat Exchanger Tubes contain the *right* amount of antimony needed to resist dezincification and other forms of corrosion. That's why *Chase* tubes last so much longer!

And antimony will *not* weaken the tube in other ways! That's why *Chase* tubes *stay* sound through years of adverse conditions in the field!

When you replace Heat Exchanger Tubes, or plan a new installation, get the benefit of *extra* years of service. Insist on Chase Antimonial Admiralty.

Learn more about corrosion problems, and how Chase can help solve them. Send for free Chase Condenser and Heat Exchanger Tube Booklet.

TRI-CLOVER FITTINGS

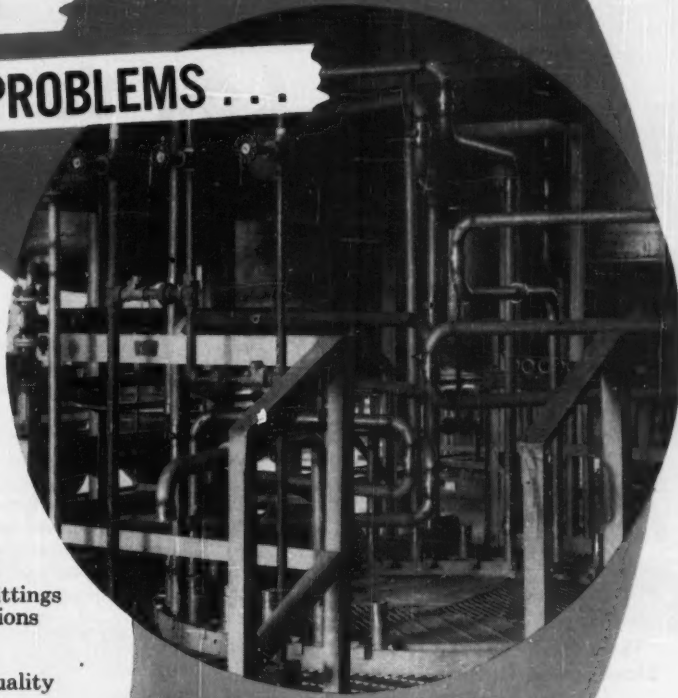
SOLVE CORROSION PROBLEMS . . .

... Simplify Liquid Conveying Lines at ELI LILLY'S New Tippecanoe Plant

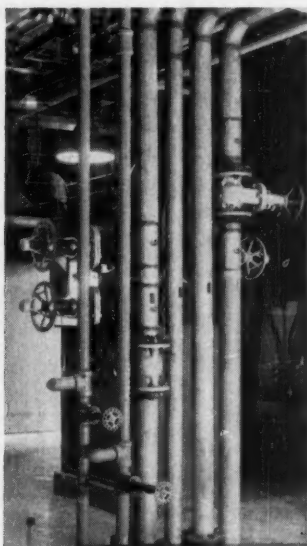
Eli Lilly & Company, experienced users of Tri-Clover stainless steel fittings, have selected Tri-Clover once again—this time for use in numerous corrosion-resistant liquid conveying lines throughout their new Tippecanoe plant at Lafayette, Indiana.

Shown are some of the many processing lines at the efficient new pharmaceutical plant where Tri-Clover stainless steel welding and sanitary fittings are used to simplify piping, "streamline" operations and to provide the greatest possible degree of corrosion-resistance and sanitation.

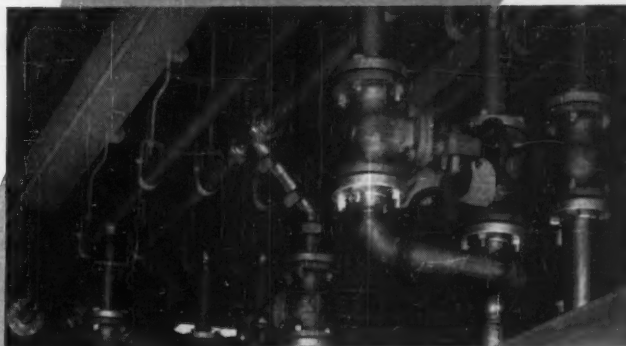
With a complete line of all types of highest quality stainless steel fittings, valves, pumps and tubing, Tri-Clover is extremely well qualified to help you solve your corrosion-resistant piping problems.



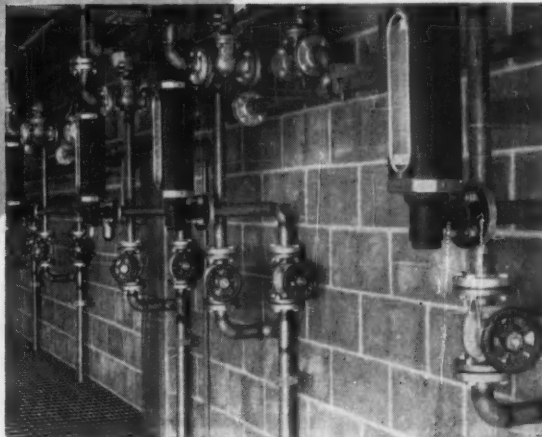
Tri-Clover stainless steel butt welding fittings together with Tri-Clamp "snap action" connections eliminate complicated valve set-up in Radial Connector System.



Tri-Clover stainless steel butt welding fittings used with supply lines from solvent storage area.



Tri-Clover stainless steel butt welding fittings and sanitary fittings used as supply lines for carbon columns.



Tri-Clover stainless steel butt welding fittings used in connection with carbon column flow controls.

LADISH CO.

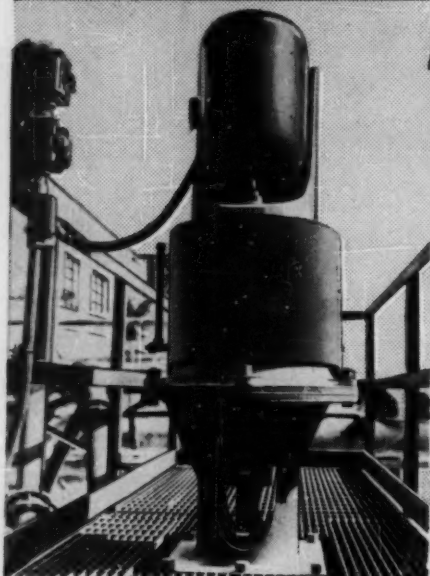
Tri-Clover Division
Kenosha Wisconsin

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INTERNATIONAL

Low Cost Operation Means More Today Than Ever Before



**Type GFR "INTERNATIONAL"
Slow Speed Turbine Type Mixer**

Courtesy, International Minerals and
Chemical Corp., Bartow, Fla.
Weldforged Grating by Kerrigan Iron Works

WHO CARES ABOUT COMPETITION? You do, and so does everyone else. You cannot ignore the fact that somebody, somewhere, is after the business that has been normally yours. In the final analysis as of today, it's lower operating costs that will enable you to stay in a competitive market and show a profit.

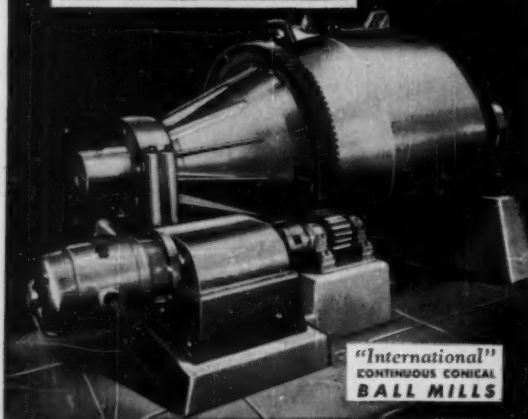
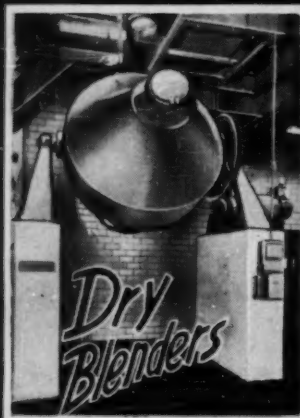
Since basic materials, labor and overhead remains about equal, isn't it logical then to look for profit-eating leaks in outmoded or inadequate equipment? One obsolete unit could be costing you plenty

in wasteful operation. Fact is, there are very few processing plants where production efficiency could not be improved, and usually at relatively small investment.

INTERNATIONAL Sales Engineers are available, without cost or obligation, to check over your present facilities, and make whatever recommendations are necessary to reduce costs and put your plant in a more flexible and stronger competitive position. Why not call us, or write for Technical Bulletins and full information on any of your processing problems.

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INTERNATIONAL ENGINEERING offers the most complete line of Modern Processing Equipment ever presented— geared to your present and future needs— with a completely balanced System of Operation for low-cost, peak efficiency. Our unmatched facilities and experience are at your service.



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Material: Activator solution—water with 5% ferro-sulphate.

Problem: Short service life of turbine pumps; sometimes only two weeks.

Solution: First Moyno ran 6 months without a breakdown. Using relief valves, pressure is kept at constant 120 p.s.i. Now using 7 Moynos because of this exceptional service.

Material: Anti-scale boiler treatment. (Alcohols, oils, anti-foam agents, sludge conditioners.)

Problem: Frequent pump breakdowns caused by back pressure of spray nozzles, and abrasion.

Solution: Moyno pumps cut pumping time from 20 minutes to 3, reduced down-time, increased production 200%!

Material: Caustic solution—for use in mercerizing machines.

Problem: Rotary pumps wore quickly; lost capacity, and did not have enough suction.

Solution: Moyno pumps cut maintenance and repairs to minimum—had ample suction for drawing caustic through the cloth.

Material: 40° copperas crystals in 20% sulphuric acid.

Problem: Low production of diaphragm pump.

Solution: Moyno pump handles an increased percentage of solids, which in turn increases production.

Material: Calcium carbonate slurry.

Problem: Continuous failures of centrifugal pumps.

Solution: Moyno pump still giving perfect service after 1½ years. Service is practically continuous—with pump in operation 24 hours per day.

Material: Size—containing china clay and latex.

Problem: Centrifugals unable to handle viscosity—causing frequent trouble.

Solution: Moyno pump has been on duty for a year. Pump trouble completely eliminated; no repairs required.

Six Chemicals-Handling Problems... Solved by the MOYNO® PUMP!

Features of the MOYNO that may solve YOUR pumping problem

Positive Displacement—Moynos are available to pull up to 29" vacuum while discharging under pressure. Big Moynos deliver up to 250 g.p.m. at pressures to 600 p.s.i.

Gentle—No churning; won't break up semi-solids; won't aerate liquids.

Reversible—The Moyno pumps with equal efficiency in either direction.

Versatile—handles liquids, abrasive slurries, pastes—even potato salad! Rotor and stator are available in stainless steel, other alloys or plastics to meet a wide variety of applications.



Trouble-Free—self priming; won't cavitate or vapor-lock. Just one moving part—no valves to stick, no pistons to gum up. Built for tough service. Easy to maintain.

Looking for a pump with a fast-growing reputation for solving tough pumping problems? Then take a look at the simple, versatile Moyno!

Briefly described above are a few of the many successful case histories proving how Moynos handle jobs where other pumps fail. Why is the Moyno a "problem-solving" pump? For one thing, because it differs completely from conventional pumps . . . rotary, centrifugal or piston. Just one rugged moving part—a rotor turning within a stator—does the job.

The list of chemicals handled by Moynos gets longer every day. If you have a pumping problem, such as handling abrasive slurries, mild acids, caustics—watery, viscous or even semi-solid—find out if the Moyno can help you! Use the coupon below for prompt, complete information.

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SPRINGFIELD 99, OHIO • BRANTFORD, ONTARIO



Fractional & Integral h.p.
Motors & Generators



Electric
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Moyno
Pumps



Propeller Industrial
Ventilating Equipment

Robbins & Myers, Inc.
Pump Division, Springfield 99, Ohio

CE

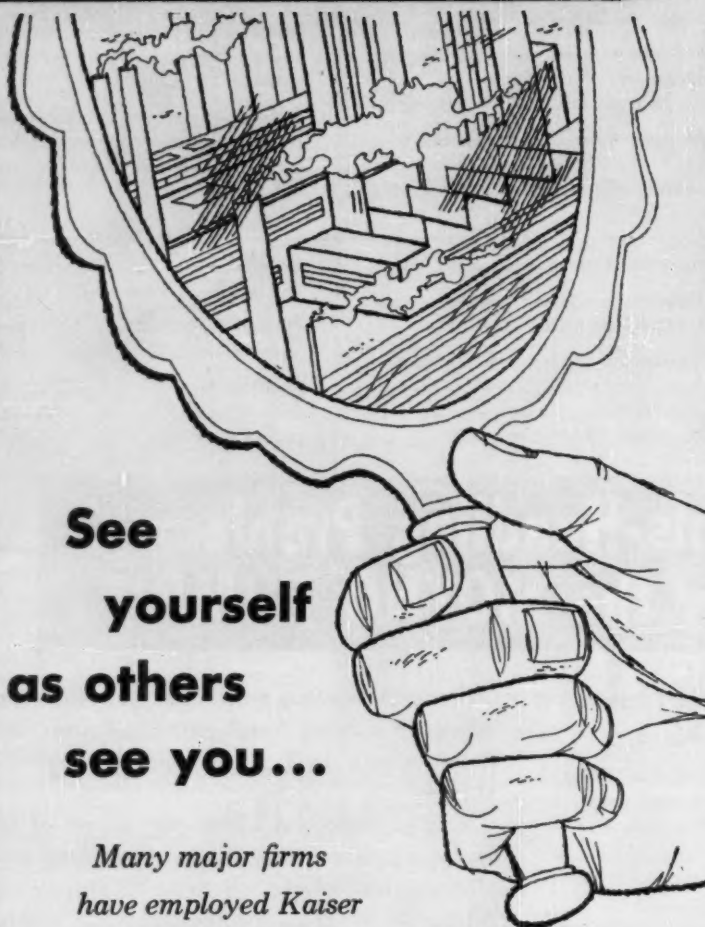
Gentlemen: Please mail free copy of Bulletin 30-B containing details on construction and operation of Moyno Pumps:

Name _____ Title _____

Company _____

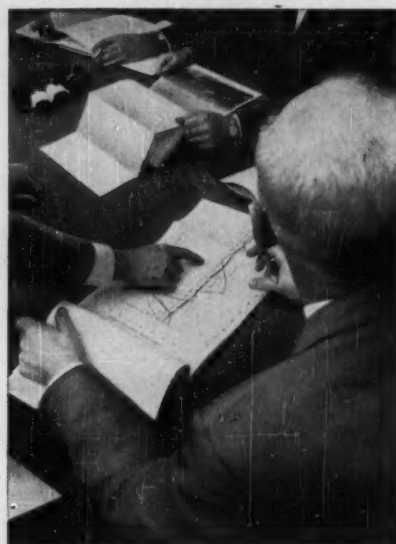
Address _____

City _____ State _____



**See
yourself
as others
see you...**

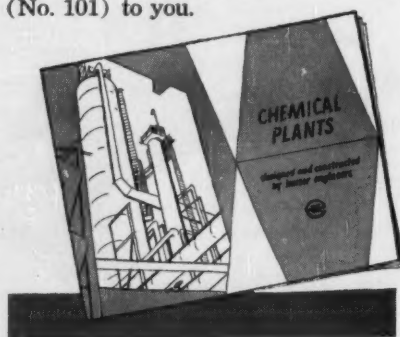
*Many major firms
have employed Kaiser
Engineers to analyze their present
problems and appraise future needs
and prospects. Kaiser Engineers
is particularly well qualified to provide
this fact-finding service, for it
has a wide diversity of talents to prepare
engineering and economic feasibility
reports, market and site location studies.*



Always an Intriguing Prospect
is the possibility of low cost development of a rich, remote deposit of a basic chemical. Kaiser Engineers recently completed a study of such a project in sulphur, including development, production, international marketing, financing and the future trends of the sulphur industry.

In your next new development, a complete analytical feasibility report by the KE team of specialists will provide a solid groundwork for engineering and management decisions.

Write today. We will be happy to mail our new chemical processing brochure (No. 101) to you.



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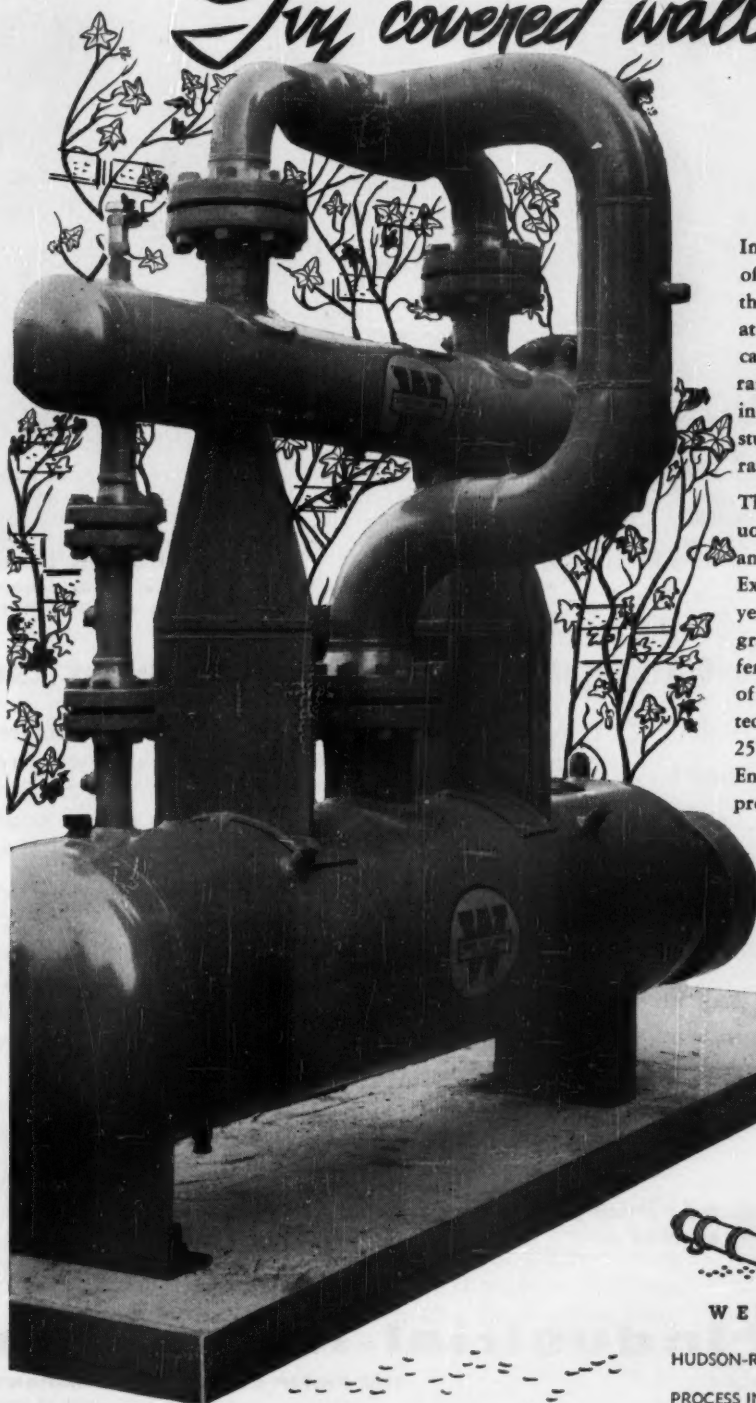
"THE
BRAND
OF
PROGRESS"



By Heat Exchanger Specialists

▲ SYNOPSIS OF AD NO. 2: Although Western Supply Company serves the petroleum, chemical and petro-chemical industries nation-wide, the company's physical plant is limited. These limitations, however, have been carefully planned to offer Western's customers a flexible service in heat exchanger fabrication from both common and alloy metals. Although not the largest, Western is recognized as one of the most modernly equipped heat exchanger plants in the country.

Inv covered walls for better **HEAT EXCHANGERS**



In an effort to add to the knowledge and technology of heat transfer, Western Supply sponsors research at the internationally known Petroleum Sciences College at the University of Tulsa. Heat transfer rates are carefully studied using various fluids under a wide range of temperatures and pressures. With equipment installed by Western, students and professors may study boiling, condensing, forced convection transfer rates and fouling characteristics.

This, however, is but one phase of Western's continuous research program. In addition, the company is an active participant in the studies of the Tubular Exchanger Manufacturers Association. For several years TEMA, in cooperation with other technical groups, has been conducting tests on shell-side transfer rates using equipment installed at the University of Delaware. Metallurgy, too, is studied by Western technicians and an experienced metallurgist of over 25 years experience consults daily with Western Engineers on welding, heat treating and corrosion problems as well as exchanger structural design.

The above is a brief summary of Western's research program . . . a program designed and carried on to offer you, the customer, the benefits of better design, better construction for increased operating efficiency and longer life for your Western Heat Exchangers.

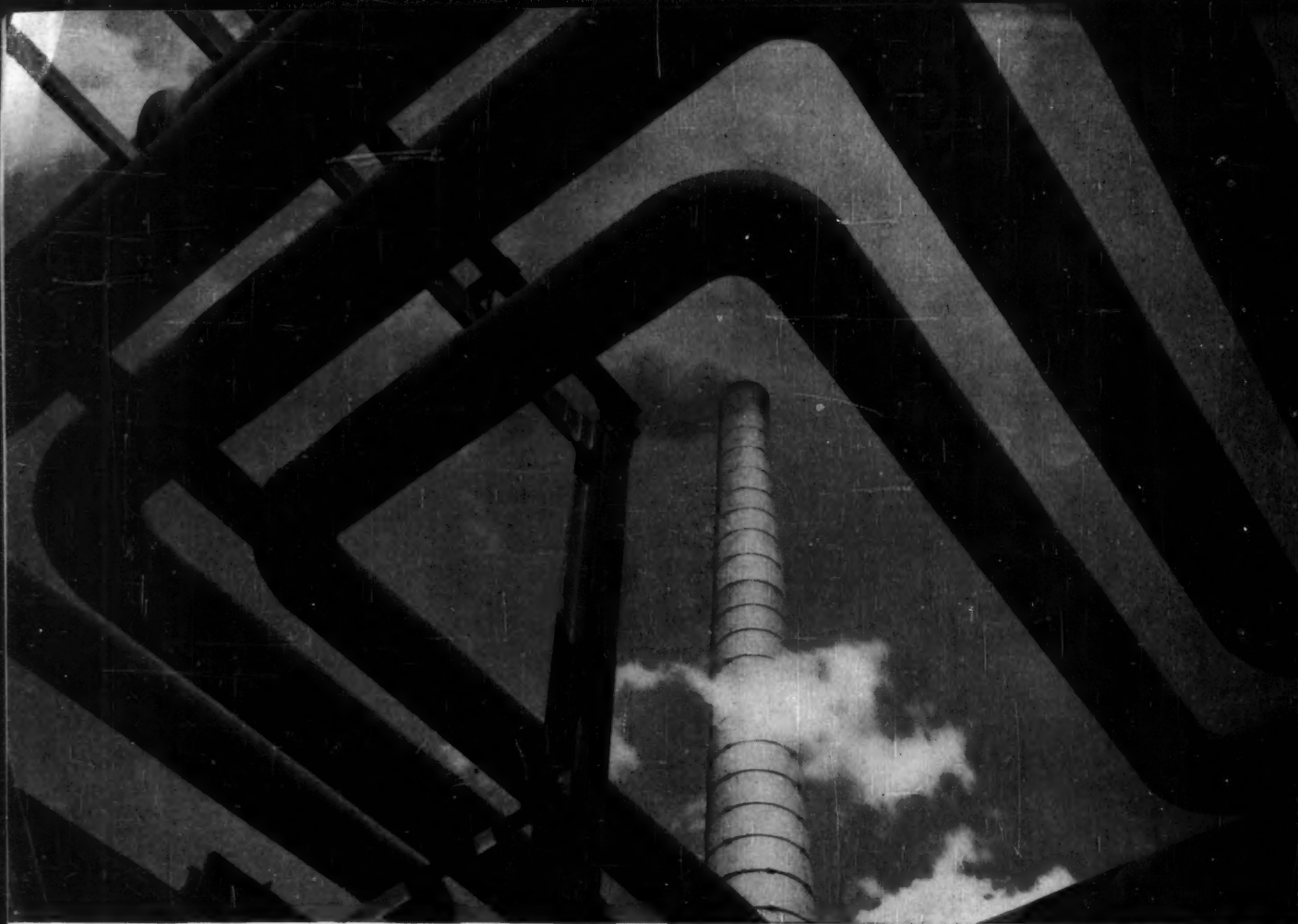
*Third in a new series
of advertisements*



WESTERN HEAT EXCHANGERS

WESTERN SUPPLY COMPANY
P. O. BOX 1888 • TULSA, OKLAHOMA

HUDSON-RUSH COMPANY—753 Gladstone Blvd., Shreveport, La.
130 Casa Linda Plaza, Dallas 18, Texas
PROCESS INSTRUMENTS & EQUIP. CO. - North Bldg., Charleston, W. Va.



"Worm's eye" view of live and exhaust steam lines protected with Carey insulation at Gulf's Port Arthur, Texas refinery.

25th Anniversary of tough Texas service at Gulf

...Carey Magnesia Insulations defy vibration, humidity, heat!

Continuous outdoor service for 25 years! That's the record set by Carey magnesia insulation at Gulf Oil Corporation's big refinery, Port Arthur, Texas. And here, service conditions are really rugged. Besides the unmerciful vibration, expansion and contraction present in every refinery operation, you have blazing sun, high winds, heavy rains and corrosive salt air!

Carey's experience in development and manufacture of insulation products since 1873 is *one* big reason why Carey insulations are so outstanding. And it's the reason, too, why we believe we can help you solve your heat insulation problems, unusual though they may be.

The Carey line includes insulation for sub-zero to 2500° F service. Major products are Super-Light 85% Magnesia and Tempchek in precision-sized blocks and nesting "O. D." pipe coverings; blankets; pipe wrapping and jackets; cements. All excel in ease of application; are economical to use. Ask your Carey Industrial Sales Engineer for helpful advice.

*Quality Products for Industry,
Farm and Home Since 1873*

*Write for your free copy
of catalog giving complete
technical and application data.
Address Dept. CE5.*



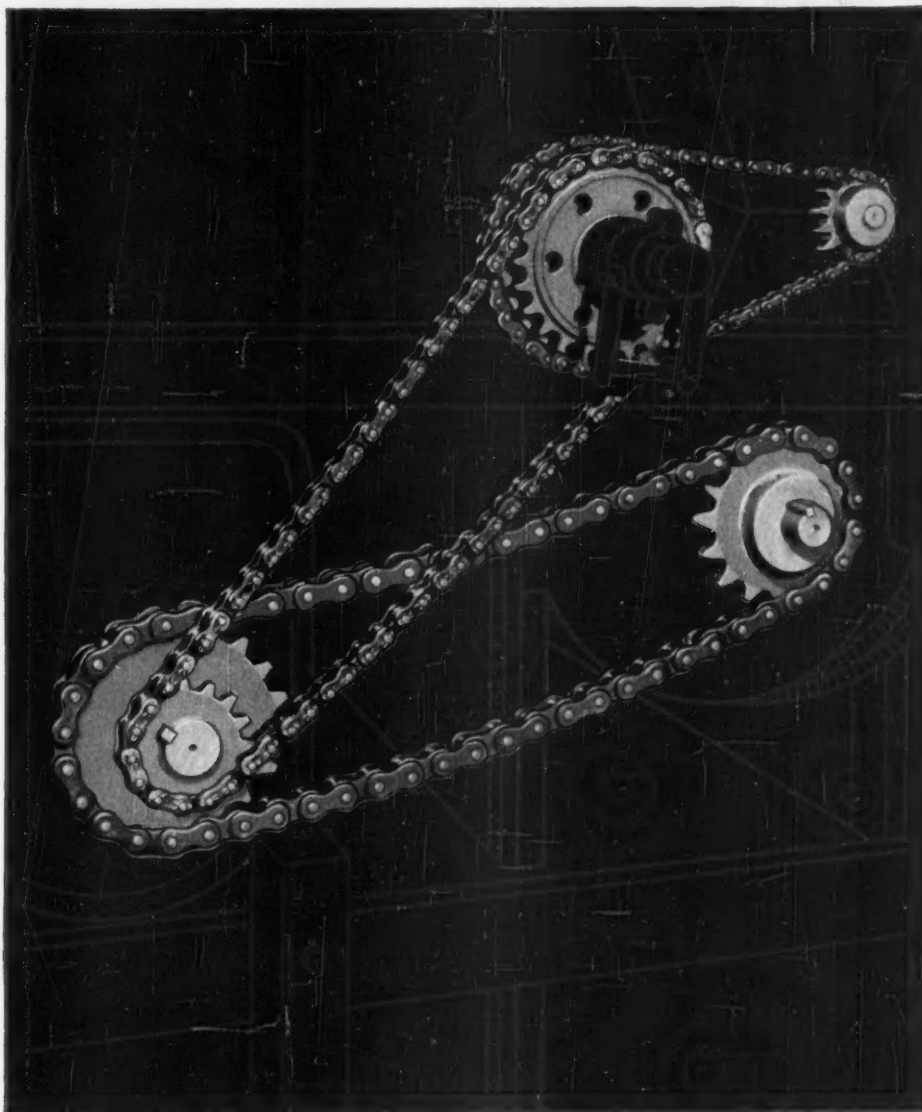
Carey Industrial Insulation

THE PHILIP CAREY MFG. COMPANY
Lockland, Cincinnati 15, Ohio

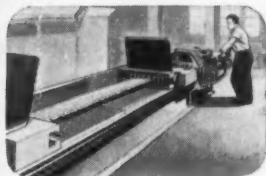
In Canada: The Philip Carey Co., Ltd., Montreal 3, P. Q.

Carey-approved contract units in major trading areas. Consult your nearest Carey District Office or your telephone directory.

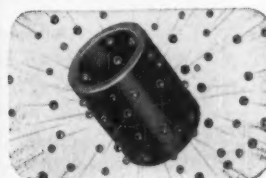
In roller chain...EXTRAS* like these give you extra reliability



LOCK-TYPE BUSHINGS (applied on a range of sizes) end a cause of stiff chain.



PRE-STRESSING of multiple width chain provides uniform load distribution.



SHOT-PEENED ROLLERS have greater fatigue life, added ability to withstand impact.



CLOSER HEAT-TREAT CONTROL — coupled with rigid testing insures uniformity.

*And you pay no premium for these LINK-BELT extras

BIG reason why Link-Belt Precision Steel Roller Chain is first choice for so many tough jobs is that it has *extra reliability built-in*. For example, pre-stressing smooths out any irregularities of multiple width chain *in advance*. And it's just one of many *extras* you get as *standard* from Link-Belt. Check the three others shown here. Then call the Link-Belt office or authorized stock carrying distributor near you for facts on Link-Belt's complete range of roller chain and sprockets. Data Book 2457 gives full information on single and multiple widths, in $\frac{1}{4}$ " to 3" pitch, 1" to 3" double pitch. Ask for your copy.

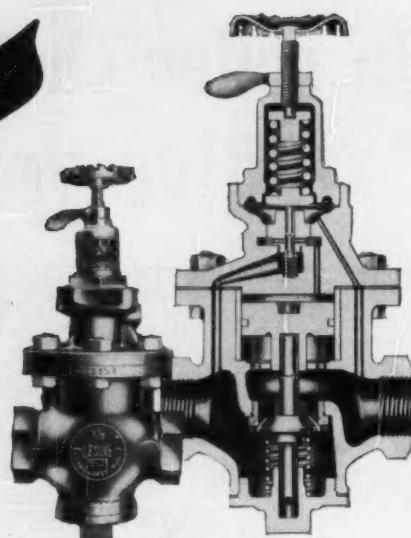
LINK-BELT
ROLLER CHAIN & SPROCKETS

19,702

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Austria, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

the PRESSURE'S ON!

**STEADILY,
CRITICALLY,
AUTOMATICALLY,** with



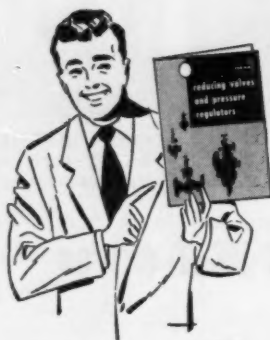
LESLIE- PRESSURE REDUCING VALVES

No need for costly, complicated two-stage reducing stations when you handle high pressure drops with Leslie Pressure Reducing Valves . . . ideal for steam heating installations or for process reductions.

Leslie design, materials and workmanship have proved successful for more than 55 years in all kinds of industrial heating applications. The single-seated, internal pilot, piston operated construction of Leslie regulators can handle pressure drops up to 1500 psi and higher and are being used successfully in pressure generating stations all over the U. S.

Send for the bulletin described below today.

- For Steam, Air, Gas
- 99% Accuracy of Regulation
- Instant Reaction to Flow Change
- Stellite Seating Surface
- Positive Dead-End Shut-Off
- Interchangeable Parts



BULLETIN 5302

Provides latest engineering data on all classes of Leslie Pressure Reducing Valves—assists you in planning and specifying for optimum performance. Yours on request.

TYPICAL PRESSURE RANGES				
CLASS	BODY MATERIAL	SIZES	INLET STEAM PRESSURES	REDUCED PRESSURE RANGE
LLK	Cast Iron	½"-6"	25-250	2-35
LK	Cast Iron	½"-6"	25-250	10-235
LL-3	Cast Bronze	½"-4"	25-300	2-35
L-3	Cast Bronze	½"-4"	25-300	10-285
LL-4	Cast Bronze	5"-6"	40-300	5-35
L-4	Cast Bronze	5"-6"	40-300	20-275
IS-2	Cast Carbon Steel & Cast Alloy Steels	½"-3"	300-750	100-600
HS-3		1"-3"	300-1500	100-600

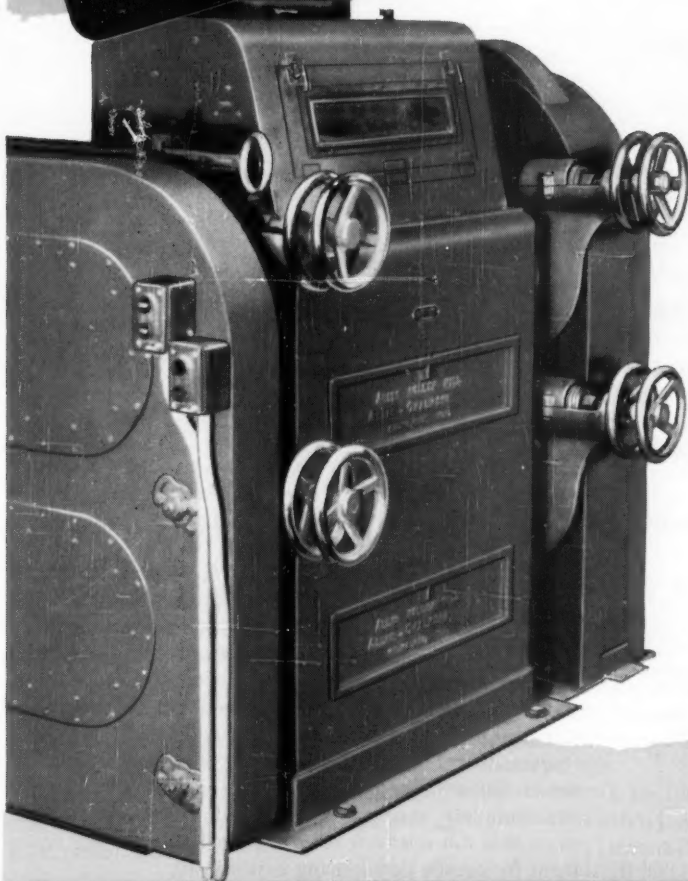
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— LESLIE CO., 279 Grant Avenue, Lyndhurst New Jersey —

ACTIVATED CHARCOAL PROCESSOR INCREASES YIELD FROM 53% TO

76%

**ALLIS-CHALMERS
ROLLER
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Single Pass Multiple Stage Milling Paid for Itself First Year!

By replacing a hammermill yielding 53% of usable product with a modern Allis-Chalmers two pair high roller mill, a charcoal processor increased his minus 10, plus 28-mesh screen yield to 76%.

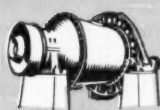
Because of the increase in yield, this mill, operating with an Allis-Chalmers gyratory screen, *paid for itself in less than a year!*

This big increase was made possible by the *gentle* size reduction afforded by roller mill grinding. There is no excessive shattering and no size destroying impact. And, multiple stage grinding in roller mills minimizes fines.

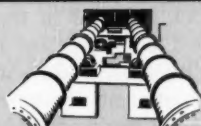
To meet your varying requirements in chemical processing, Allis-Chalmers roller mills are built in one, two and three pair high models. Double and triple roller mills are used when no separation is necessary between reductions. Roll lengths range from 18 to 42 inches in 9 and 10-inch diameters.

For complete information on roller mills and other equipment for your industry, call your A-C representative or write Allis-Chalmers, Milwaukee 1, Wis.

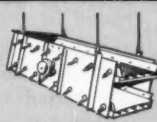
Other Processing Equipment for the Chemical Industry



Grinding Mills



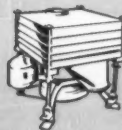
Kilns, Dryers, Coolers



Vibrating Screens



Compacting Mills



Gyratory Screens



Man-Lifts

ALLIS-CHALMERS



Today's Technology and Economics in . . .

Vegetable Oil Refining

WHEN you are considering a new process, capital investment, process yields, raw materials cost, operating difficulties, all must be weighed and balanced against each other. If you're working in a highly competitive field, you'll study these important factors long and hard, before making a decision.

This is just what many a vegetable oil refiner is doing these days, when faced with the problem of building a new plant to refine cottonseed, soya, peanut or corn oil. But he has no easy task—he must choose from a total of seven refining methods.

This was not the case before World War II. Then he had two caustic processes to play around with—one was batch kettle refining, the other continuous centrifugal. But since then the industry has been booming—25 new refining plants completed since 1945, making a grand total of 141 vegetable oil refineries in this country.

► **Two Out of Seven**—Competition has provided the breeding ground for much process improvement. The final shake-up in vegetable oil refining may not be known for some time to come, but right now two continuous processes lead the pack. They are the commercially important methods. One is the centrifugal caustic process; the other a centrifugal modified soda ash process. For process details see the flowsheet. Typical caustic process: Southern Cotton Oil plant in Chicago. Typical modified soda ash process: Spencer-Kellogg & Sons, Edgewater, N. J. Both engineered and installed by The Sharples Corp.

Both commercial methods use similar equipment, particularly centrifugal separators. Each takes a crude oil from a mill and: (1) mechanically separates water, (2) precipitates and removes gums, (3) neutralizes and precipitates free fatty acids, (4) reduces color.

► **There Are Differences**—The caustic process uses a 15 to 25% caustic soda solution, loses oil by saponification, but has a relatively low capital investment since it needs no separate decolorizing step.

The modified soda ash process uses a 15% soda ash solution, has little or no saponification loss, but requires an extra decolorizing step, which increases capital investment by 25% over caustic.

Other methods are in use in this country, but on a limited scale. For instance, you can't beat batch kettle refining for low capital investment. This well-known method calls for a simple agitated tank (20,000-100,000 lb. cap.) fitted with a heating coil. Caustic is added, the solution stirred and heated. The precipitate of soapstock settles for 2-4 hr.

There are two big disadvantages to this procedure. One is that the soapstock contains 50% oil, and with crude cottonseed oil selling for around 15¢ lb. this can be a major loss in a 240,000 lb. day plant. Also, the long contact time between caustic and oil produces saponification. This amounts to 1% of the crude oil charge.

► **Different Engineering Approach**—Actually, the centrifugal caustic process involves identical chemical reactions to batch caustic refining. But the centrifuge, not a settling tank separates oil from soapstock. Modern plants

Caustic Process



Modified Soda Ash Process



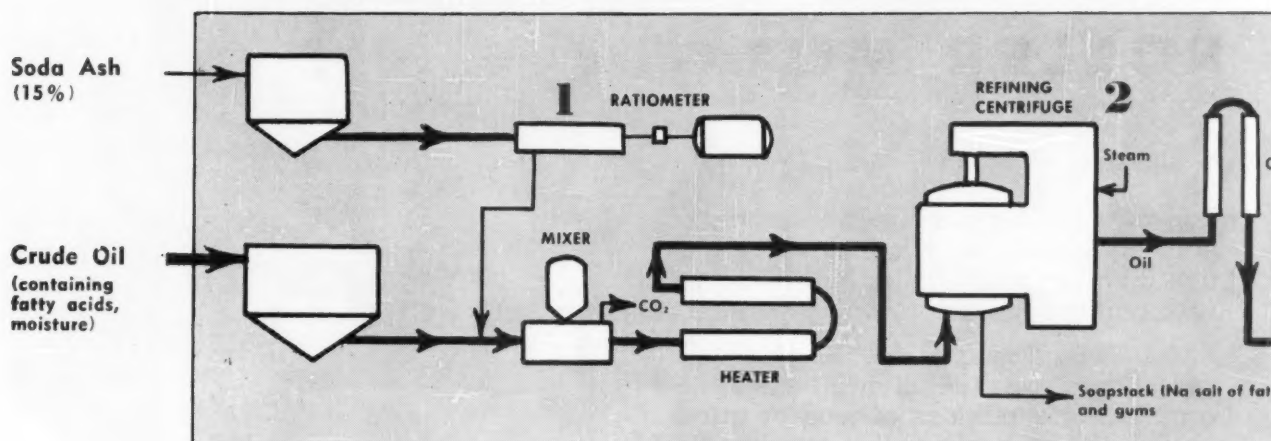
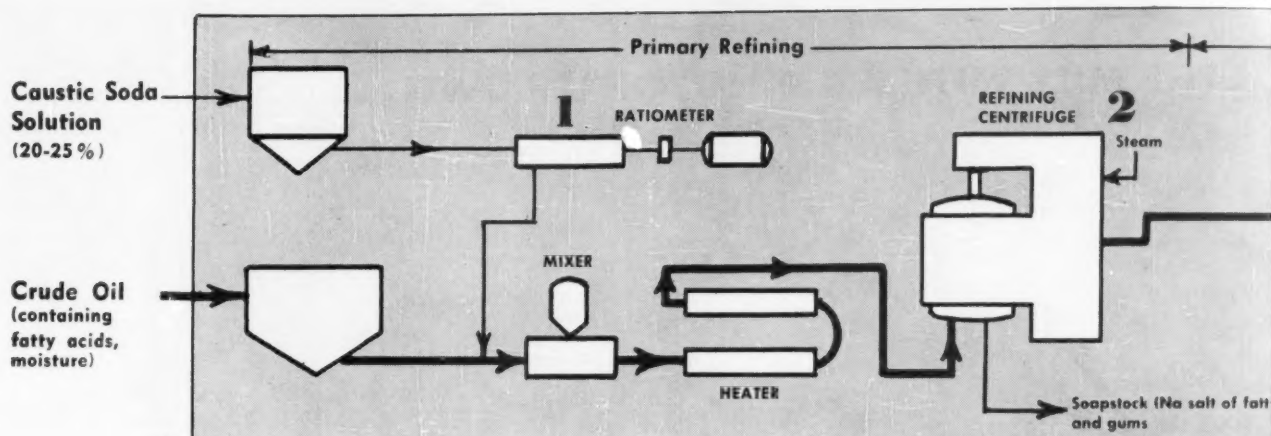
use a centrifuge capable of 16,000 G. Soapstock oil content is about 20%. Saponification still takes place, but is down to about 0.1% of the crude oil. Capital investment is 100% higher than kettle refining.

Saponification is a problem in continuous caustic refining, particularly for production rates over 200,000 lb. per day. Triglycerides are saponified by caustic soda in the soap phase (soap catalyzes the reaction) even with short contact times.

This is where the modified soda ash process comes into the picture. For it answers the refiner's need for a reagent that does not saponify vegetable oil. Soda ash meets this requirement perfectly. But this process is not the complete answer. A decolorizing step is required, since soda ash does not remove color bodies. More equipment for caustic decolorizing is necessary.

One early difficulty with modified soda ash refining, centered around the formation of stubborn emulsions, created by the CO₂ given off in the reaction. Now this gas is quickly vented, preventing any accumulation.

► **What About Other Methods?**—Aqueous ammonia has been tested in pilot-plant equipment, but this process needs totally enclosed equipment. An early soda ash process—before the emulsion problem was solved—is little used in this country now. A modified caustic process (stoichiometric amount to neutralize free acids avoids saponification) is widely used outside Canada and the U. S. Refining in the micella state requires that the refinery be located at the extraction mill.



Reagents and Utilities

Caustic Process

	Per 100 lb. Crude Oil
NaOH ¹	0.25 to 1.12 lb.
Electricity ²	0.34 kwh.
Steam ³	18 lb.
Process water ⁴	12 gal.

¹Range of treats from 0.1% for 1% free fatty acid crude, to 0.4% excess for 5% free fatty acid.

²Based on 85% efficiency, 80% of full load.

³30 psi.

⁴Includes water wash, makeup and condenser.

Modified Soda Ash Process

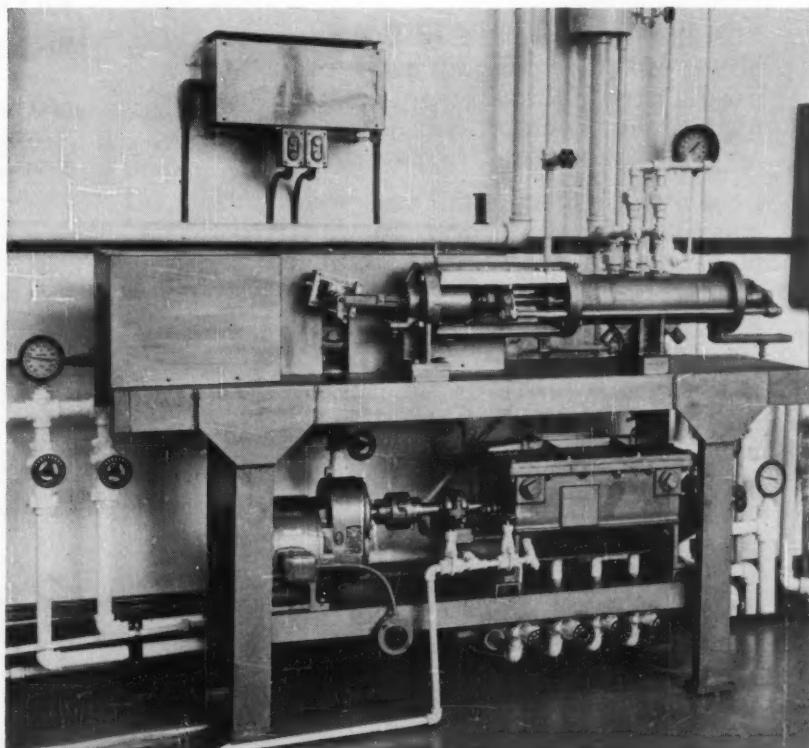
	Per 100 lb. Crude Oil
Soda Ash ⁵	0.06 to 0.98 lb.
NaOH ⁶	0.72 to 1.7 lb.
Electricity ⁷	0.54 kwh.
Steam	23 lb.
Process water ⁸	7.5 gal.

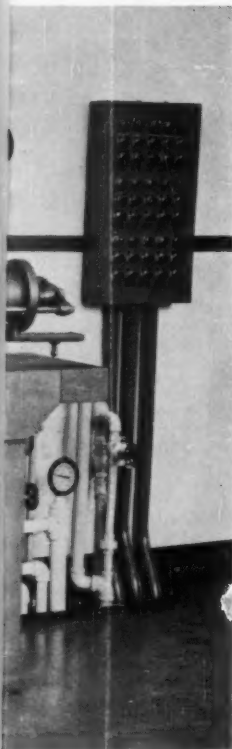
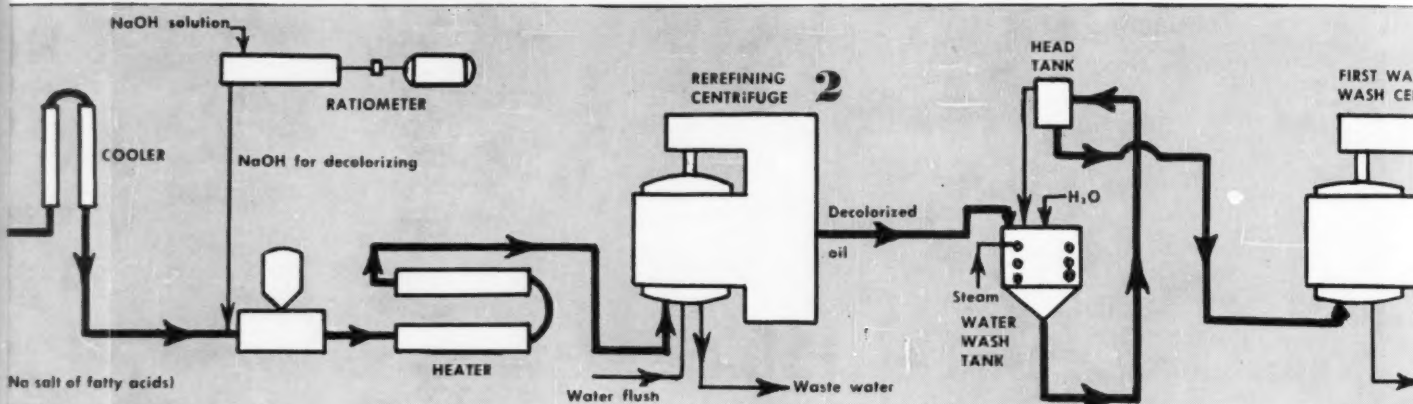
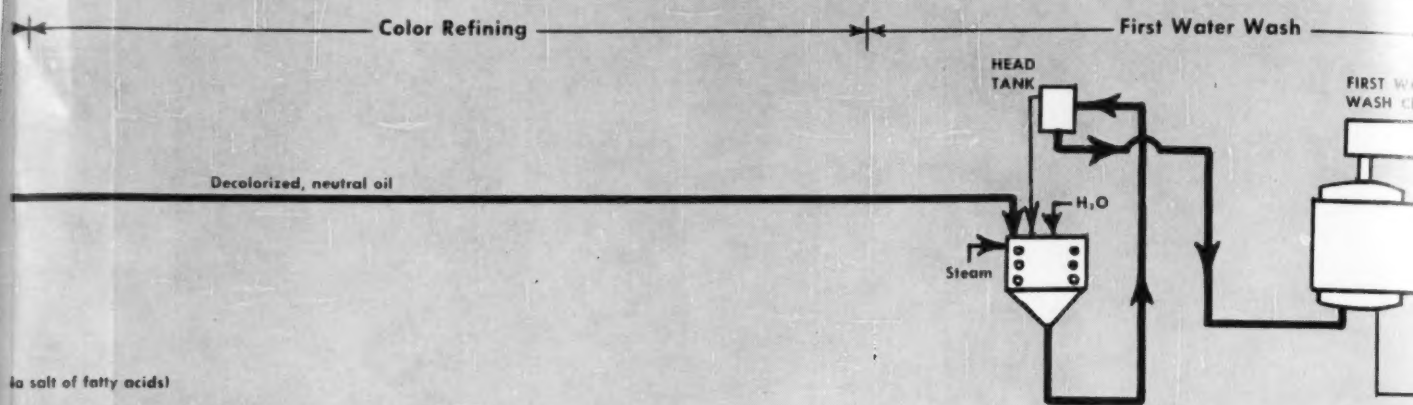
⁵Range of treats from 4% to 10% excess 22 Be. soda ash.

⁶Range from 1% excess of 10 Be. to 5% of 26 Be.

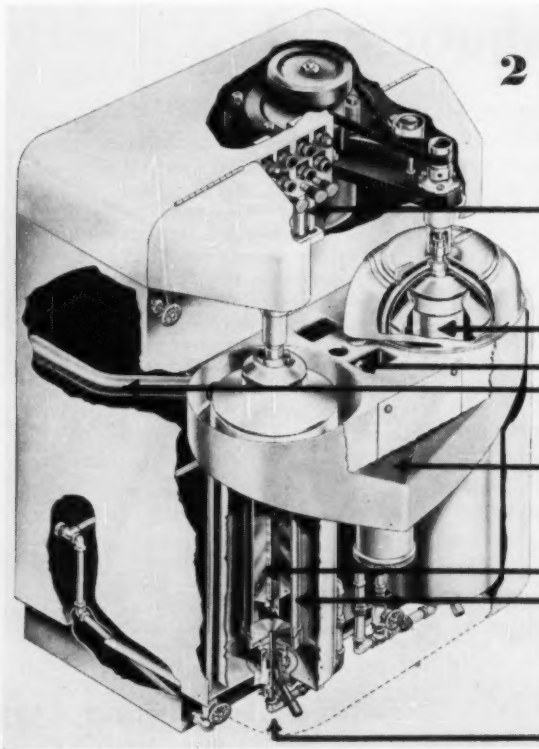
⁷Based on 85% efficiency, 80% of full load.

⁸Soft water makeup, flush and wash.





The Sharples Corp.



The Sharples Corp.

Feed Controls

Bowl

Refined oil

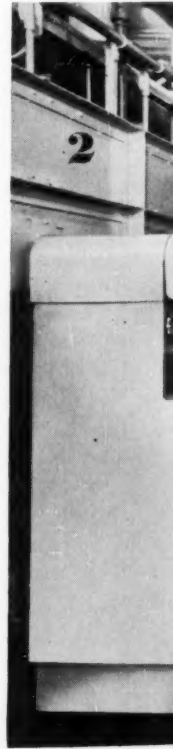
Air vent

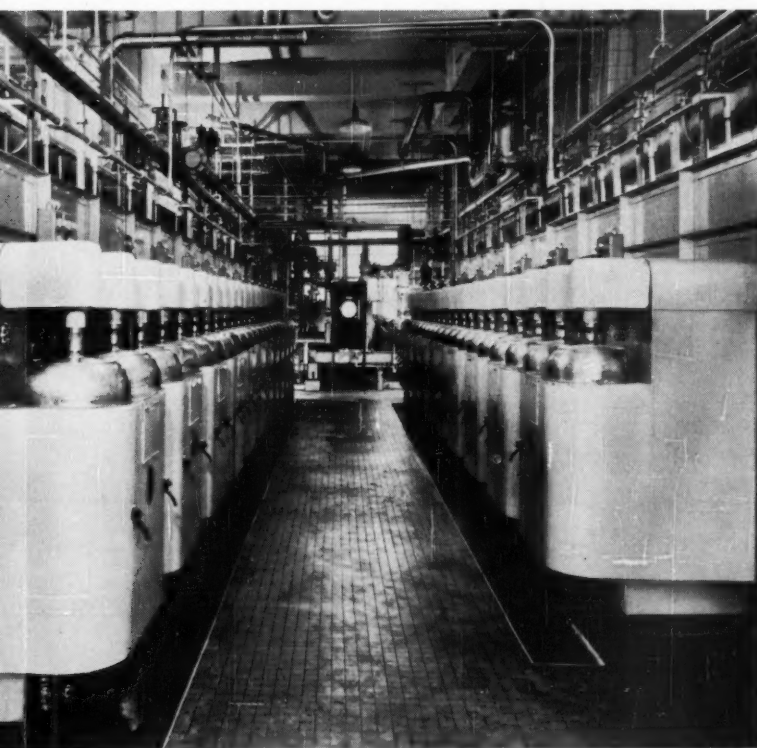
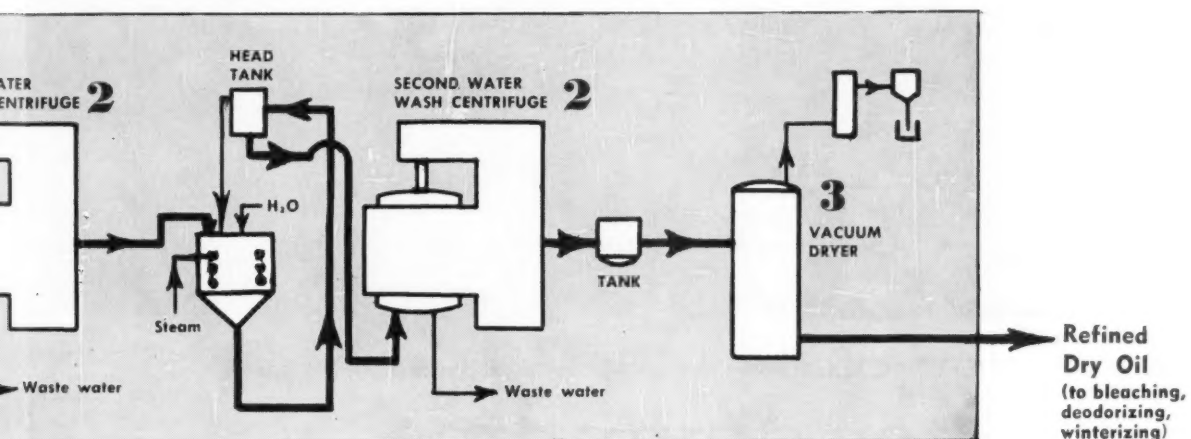
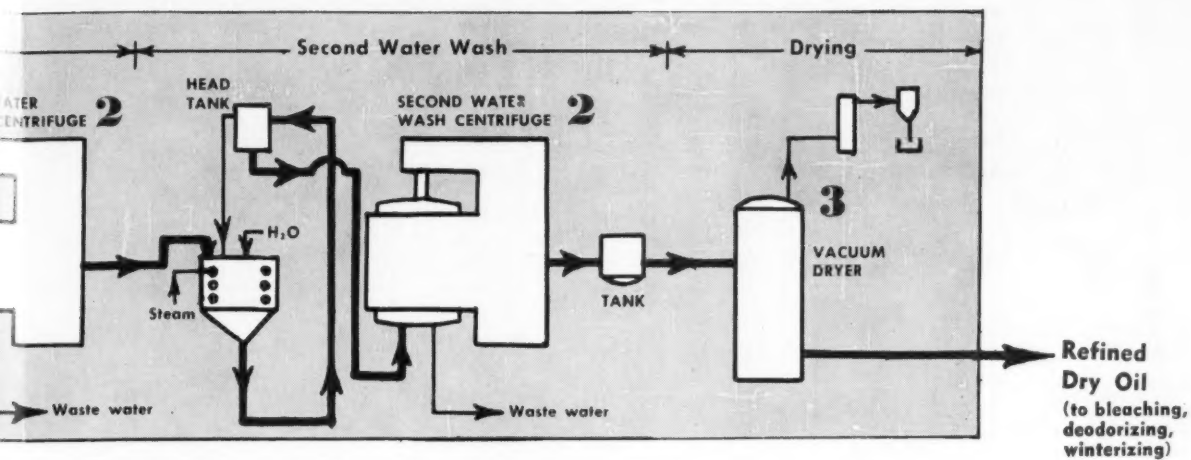
Sludge hopper

3 wing

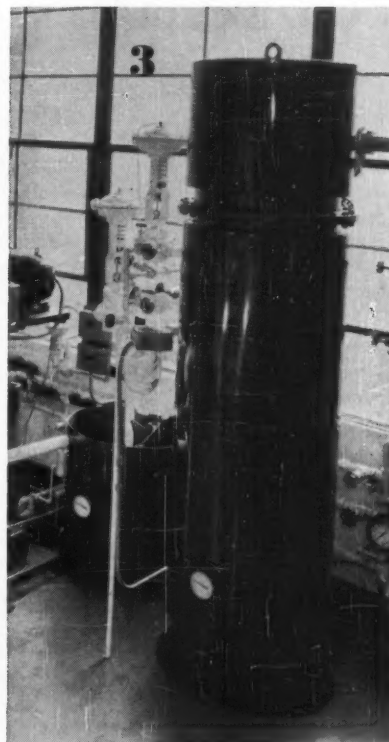
Bowl

Feed & flush input

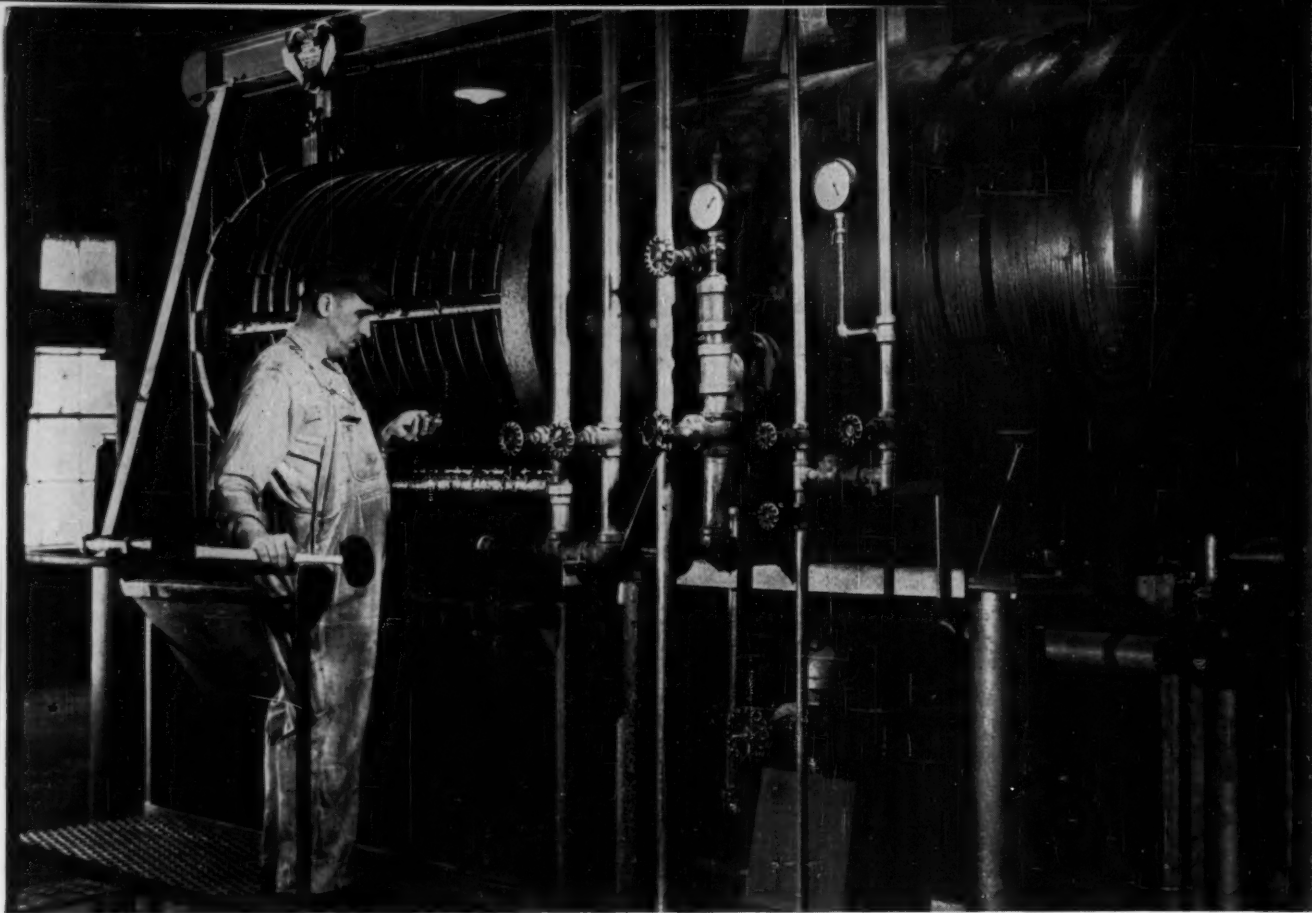




The Southern Cotton Oil Co.



The Sharples Corp.



How you can cut filter downtime as much as 85%

It's simple with a Niagara Horizontal Filter. Here's why. After the hydraulically operated "Quick-Opening" cover is opened, a few turns of the windlass rolls the entire battery of leaves out on a retractable carriage, ready for instant cleaning. *One* man can drain, clean, close, fill and precoat in a matter of *minutes* instead of *the hours* needed for most other filters. That's why downtime can be reduced as much as 85% . . . why you get more productive filter time with a Niagara.

And your Niagara Horizontal will also give you:

- Two to five times faster filtration rates
- Complete elimination of cloth expense
- Labor costs reduced to a minimum
- Dry or semi-dry disposal—a few taps or shakes of the leaves easily drops the cake into a hopper

- Positive removal of solids to almost any degree
- Plus many other cost cutting, product improving features

Niagara Filters are available, either horizontal or vertical, in a wide range of capacities up to 40,000 G.P.H. They can be made of steel, stainless steel, nickel, monel or other corrosion-resistant materials . . . rubber or plastic lined . . . steel jacketed or insulated. Niagaras are constructed in accordance with ASME requirements—pressures to 75 PSI are standard but they can be built for pressures up to 280 PSI.

The savings you make with your Niagara will quickly pay for its entire cost. This has been proven time and time again in thousands of plants in diverse industries. For the full story, mail the coupon . . . no obligation.

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A DIVISION OF
American Machine and Metals, Inc.
DEPT. C555 EAST MOLINE, ILLINOIS

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☐ Send catalog NC-1-53

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Specialists in Liquid-Solids Separation



That's the long-life valve on sulphuric acid

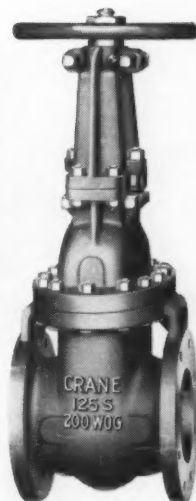
THE CASE HISTORY: At a large midwestern refinery there were recently two valves of different makes on a 90% sulphuric acid line. As seen in the photo above, these valves worked under identical conditions, almost side by side—each operated about three times daily.

Less than a year in the line, the valve at left started leaking, with the leak getting rapidly worse. In contrast, the Crane No. 475½ all-iron gate valve at right, with two years' continuous service to its credit, was still giving completely good performance.

That's Crane quality in valves—with a 100-year background in quality manufacturing. That's why Crane valves are the first choice of thrifty buyers in the petroleum industry as in all others. Crane Co., General Offices, Chicago 5, Ill. Branches and Wholesalers serving all industrial areas.

CRANE IRON BODY WEDGE GATE VALVES

Here are valves of unusual strength for their 200-pound W.O.G. rating. Body and bonnet are oval shaped, with extra metal where needed most. Their Crane-quality cast iron with highly engineered operating design makes these valves outstanding performers wherever they're used. A complete family to choose from. See your Crane Catalog or your Crane Representative.



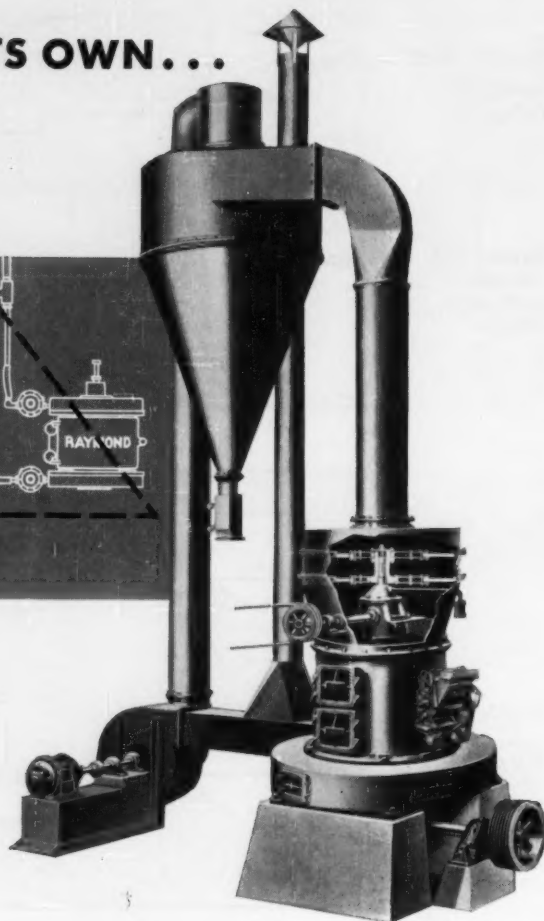
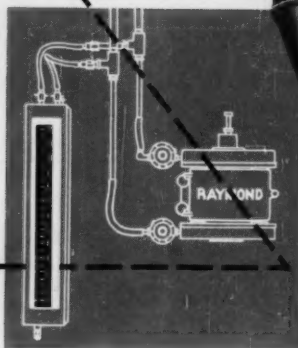
CRANE CO.

**VALVES • FITTINGS • PIPE
KITCHENS • PLUMBING • HEATING**

CRANE'S FIRST CENTURY...1855-1955

THE MILL WITH A MIND OF ITS OWN...

Raymond ROLLER MILL



You can obtain maximum productivity of your equipment by grinding your products on a Raymond Roller Mill equipped with *pneumatic feed control*.

This self-regulating device maintains the peak "load" on the mill at all times. Regardless of conditions of feed or grindability, the mill takes all it can handle, and delivers its full capacity, hour after hour.

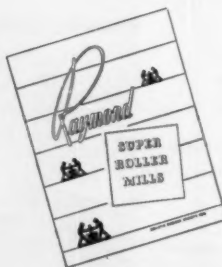
It is the *steady grind* of the Raymond Roller Mill that piles up production. No irregularity, no down-time, no forgetfulness of the operator, can affect the top-level efficiency of this machine.

In its modern design and engineering, its sturdy construction and fine bearings, its lubrication system and advanced operating features, the Raymond Roller Mill gives you a big leverage in cost reduction.

Recommended for chemicals, pigments, talc, sulphur, phosphate rock, synthetic resins, insecticides, clays, bauxite, asbestos and a great variety of non-metallic minerals and manufactured products.

RAYMOND PNEUMATIC FEED CONTROL

operates by air pressure in the mill system and is sensitive to changes in the "load", insuring continuous high capacity



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Catalog #72

COMBUSTION ENGINEERING, INC.
Raymond Division

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Sales Offices in
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John A. Scott: Man of the Month

New president of Sinclair Chemicals, a chemical engineer, has had a speedy rise in management.

Can you advance faster and farther by staying with one company, or would it pay you to move around? It's probably pretty much up to the individual and the circumstances he finds himself in. But the career of John A. Scott, newly elevated president of Sinclair Chemicals, makes a good case for the stick-to-one-company philosophy.

Since he left college, John has been with Sinclair, moving steadily up the organizational ladder—from research technologist through various engineering and administrative posts to his new position.

Only 43, he's made the ascent in short order.

► **Value of Engineering**—This quick climb was no accident. For

a long time John's had a fairly good idea of where he wanted to go. And an early start on his training and a good sense of direction has helped him get there.

Mechanically-minded and interested in chemistry, he found high school math, chemistry and related subjects easy, so he made up his mind to study chemical engineering early.

How does Scott regard his engineering training as a preparation for management? "If by engineering training you mean developing the ability to think logically," he observes, "I feel it is excellent for developing managers." But he cautions, "It needs to be supplemented with business training and a strong interest in business. In

the last analysis, whether such training is useful at all depends largely on the interests and aptitudes of the individual."

► **Intriguing**—Scott, himself, possesses a long-standing interest in business. Even in school, he found company financial statements and the like absorbing reading. And while still in high school he gave tangible evidence of this interest by playing the stock market.

In 1934, when he received his BChE with high distinction from the University of Minnesota, Scott drafted a letter of application which he circulated to a number of companies. In it he asked for a job in which he would be developing new products and trying to pare production costs.

► **Joined Sinclair**—He soon became a research technologist with Sinclair Refining Co. in Chicago and spent the next few years pilot-planting fractionation processes. In '37 he was promoted to process design engineer and three years later became research engineer.

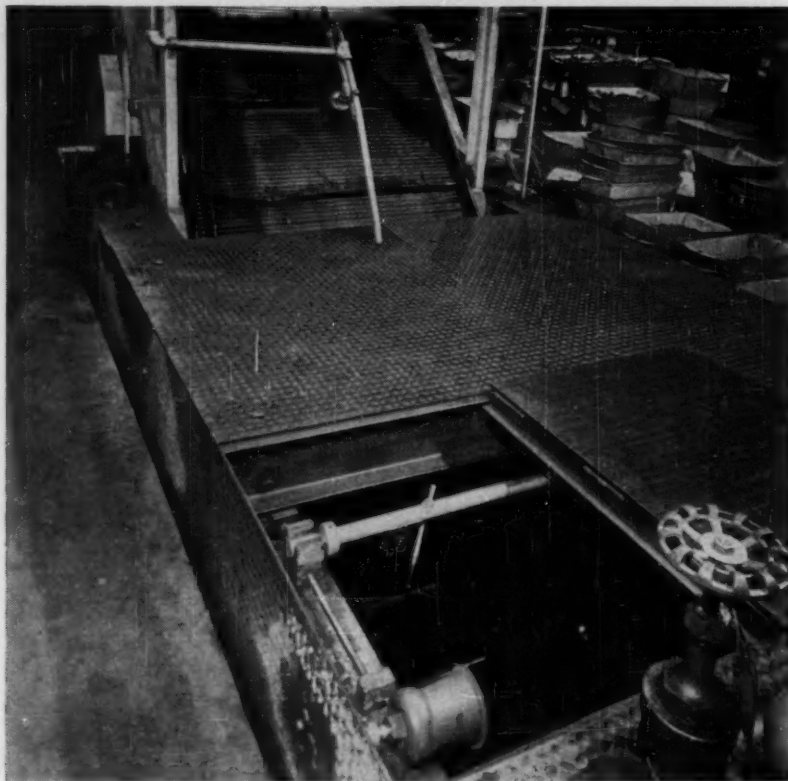
After two years of alkylation pilot plant supervision, Sinclair placed Scott in charge of the design, construction, start up, initial operation and the training of operators for one of the pioneer hydrofluoric alkylation units. The unit, in Sinclair's Corpus Christi refinery, turns out high octane aviation gasoline components via a then-revolutionary process.

► **Locale Shift**—In 1945, Scott moved to New York as assistant to the company's vice president of research and development. He was called on for technical advice on petroleum technology and was also consulted on alkylation and polymerization problems.

When Sinclair Refining organized a petrochemical division in 1951, it named Scott manager. And the following year, when this division became Sinclair Chemicals, Inc., he was selected to be executive vice president and director.

At present, he serves as a director of Sinclair Research Laboratories,

HOT SPOT IN HARTFORD!



1575 GALLONS OF OIL NEAR A 1700° FURNACE!

A king-size oil quench is a bad enough fire hazard by itself. Put it next to a roaring, 1700 degree hardening furnace, and it could turn a plant into a cinder pile!

So the Allen Manufacturing Company discovered when they installed this hardening and tempering machine in their Hartford, Connecticut plant!

From the hardening furnace, hex-socket screws are quenched in oil, tempered, then quenched again. A flash fire in the huge oil quenching bath could mean loss of the machine, costly down time—and possible loss of the entire plant!

Safety-minded Allen executives naturally took proper precautions, held the oil far below its flash point with thermostatic temperature controls. Still, they realized

that more protection was needed! So Allen called on Kidde—long-time specialists in fire extinguishing systems.

Kidde engineers studied the problem, installed a special carbon dioxide extinguishing system which could be triggered instantly.

If fire strikes, one pull on a control handle pours clouds of fire-killing CO₂ over the blaze, snuffing flames in seconds. At the same time, pressure-operated switches in the lines automatically shut down feed and conveyor motors!

All fire hazards—dip tanks, flammable liquids and electrical equipment—are potential plant-wreckers. Make sure they get the *proven* protection of Kidde extinguishing equipment. Call your Kidde agent today!

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NAMES . . .

Inc., and a director of Calumet Nitrogen Products Co.—in addition to his new post.

► **Urges Engineers**—After handling a multitude of management responsibilities over the years, Scott makes a few observations which any engineer interested in management opportunities should heed.

He feels that "a big job of management is motivating and directing other people. The man who handles others needs to understand them—and this ability can be developed."

"While it depends a lot on the person," Scott continues, "it would not hurt any engineer to take courses in basic psychology and business law. Further, the nature of engineering is such that as engineers gain experience they tend to move into management jobs. Hence, the engineer who sets management for his goal should get into the type of job which gives him some supervisory experience real early."

Edwin Letts Oliver—Awarded the James Douglas Medal for distinguished achievement at the annual meeting of the American Institute of Mining and Metallurgical Engineers in Chicago. Mr. Oliver and **John V. N. Dorr**, recipient of the Douglas Medal in 1930, are founders and chairmen of recently merged Dorr-Oliver Inc. with headquarters in Stamford, Conn.

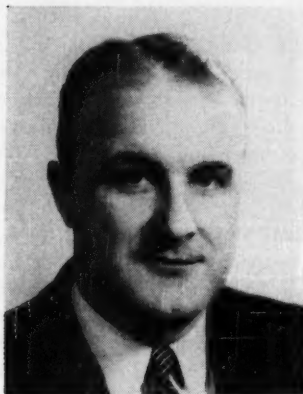
H. W. Van Ness—Assistant vice president in charge of projects for the Chemical and Industrial Corp., Cincinnati, Ohio.

Joe Tannos—Returned to his job as chemical engineer at Texas City plant of Carbide and Carbon Chemical Co., after completing a two-year tour of duty with the U. S. Navy in the Far East.

Donald Price—Consultant in the cleaning field to American Alcolac Corp. Before joining American Alcolac, Dr. Price was—for nearly ten years—technical director of Oakite Products, Inc.

James Woodburn—Assistant vice president of Gulf Sulphur Corp.'s Mexican subsidiary, Cia. de Azufre Veracruz, S. A. Dr. Woodburn was formerly professor and chairman of the department of mechanical engineering at Rice Institute, Houston, Tex.

W. Kenneth Davis—Director of reactor development for the Atomic Energy Commission, succeeding **Lawrence R. Hafstad**.



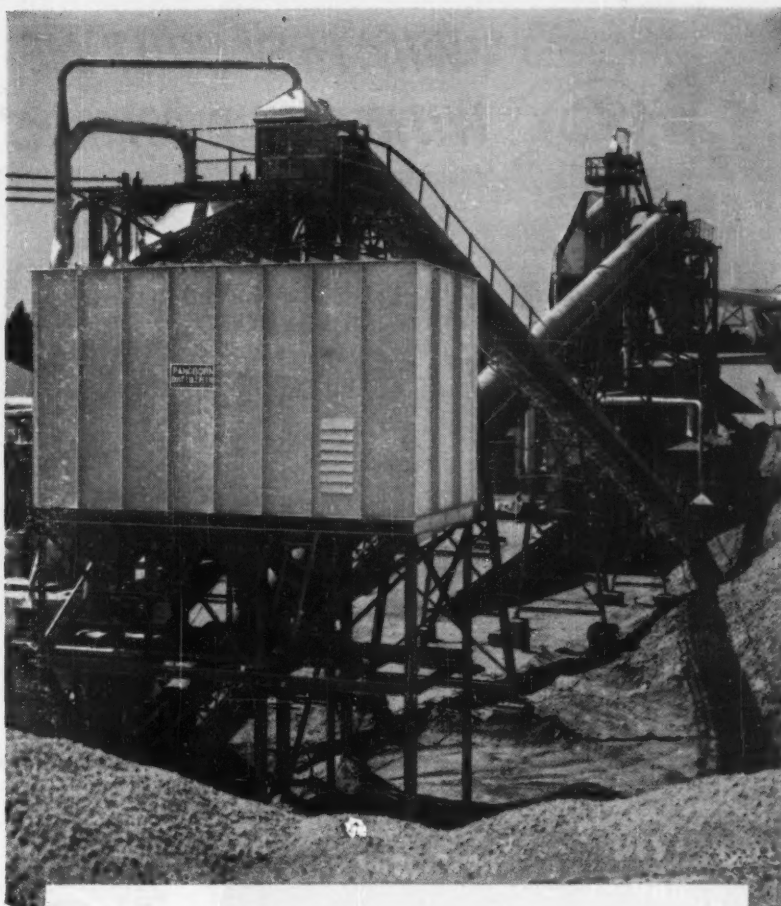
F. S. Swackhamer

Mr. Swackhamer, manager of the resins and plastics department of Shell Chemical Corp., has been elected vice president of the Commercial Chemical Development Association for 1955 and president-elect for 1956. After 12 years with American Cyanamid Co. (1936-1948), Mr. Swackhamer joined Shell as a senior technologist. He was promoted to manager of sales development in 1950 and named to his present position in 1951.

L. C. Duncan—General manager of American Cyanamid Co.'s Lederle laboratories division. **V. E. Atkins** has been named general manager of the company's organic chemicals division.

W. Edwards Dungan—Promoted to plant manager at American Viscose Corp.'s Roanoke, Va., rayon plant.

Hobart C. Ramsey—Elected to the board of directors of the Armstrong Cork Co. Mr. Ramsey, chairman and chief executive



Fletcher brings dust "down to earth!"

Pangborn Dust Control collects valuable material to be sold as soil conditioner

The H. E. Fletcher Co., West Chelmsford, Mass., produces a wide variety of granite products. When Fletcher recently expanded plant operations, the firm installed Pangborn Dust Collectors on the recommendation of an already-satisfied user of Pangborn Dust Control. The results at Fletcher have been extremely gratifying. Costs have been cut in three ways: valuable collected material is sold as soil conditioner, the life of expensive machinery is lengthened by reducing dust damage, and plant housekeeping is cheaper and easier. Other benefits, according to the company, include the reduction of health hazards to employees and the improvement of product quality.

Pangborn can solve *your* dust problem. Pangborn engineers will be glad to show you how Pangborn Dry or Wet Dust Collectors can save you time, trouble and money!



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ROUND CORNERS ARE STRONGER

The ordinates represent the approximate character of maximum stresses in the region of a square corner in a vessel under pressure. Note the considerable increase in stress of the corner.

Stress concentration is entirely eliminated. Discontinuity stresses are smaller. Hence there is little increase in stress of the corner in round corner vessels.

The techniques of fabricating equipment with round corners for efficient service were developed to a high degree in our plant. We use special machinery for this job, as we do for many phases of stainless steel fabrication.

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CORROSION RESISTANT PROCESSING EQUIPMENT



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NAMES . . .

officer of the Worthington Corp., succeeds the late C. Dudley Armstrong.

Harry T. Wentworth—General manager of the Atlas Valve Co., Newark, N. J. Mr. Wentworth, chief engineer of the company for the last nine years, will assume responsibility in the production and marketing picture as well as in the formulation and administration of future company policies.

R. P. Ganchan—Vice president and general manager of the Automotive Rubber Co., Inc. He will direct the operation of plants in Detroit and Kalamazoo, Mich.; Houston, Tex.; Savannah, Ga.

Clyde Williams—Awarded the honorary degree of Doctor of Laws by Marietta College, Marietta, Ohio. Dr. Williams is president and director of Battelle Memorial Institute, Columbus, Ohio.

Ralph N. Thompson—Manager of research for Calgon, Inc. and Hall Laboratories, Inc., chemical subsidiaries of Hagan Corp., Pittsburgh instrument and control firm.

O. Muller-Habig—President of Centrico, Inc., Englewood, N. J., succeeding **Heinz W. Habig** who died late last summer.

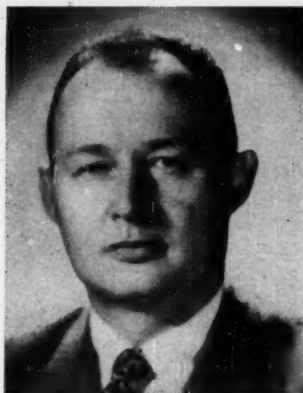
Louis D. Scott—Nylon liaison supervisor for Chemstrand Corp.'s research and development department, Decatur, Ala.

Robert L. Hutchinson—Vice president in charge of operations for Columbia-Southern Chemical Corp. **Joseph A. Neubauer** is vice president in charge of research and development.

Fred C. Foy—President and chief executive officer of Koppers Co., Inc. **W. F. Munnikhuysen** was elected chairman of the company's board of directors.

C. V. Foster—Senior chemical engineer in the petrochemical re-

search division, Continental Oil Co., Ponca City, Okla. Paul A. Lobo is research chemical engineer in the division. Calvin F. Meyers is senior research engineer in the product use laboratory.



Errol H. Karr

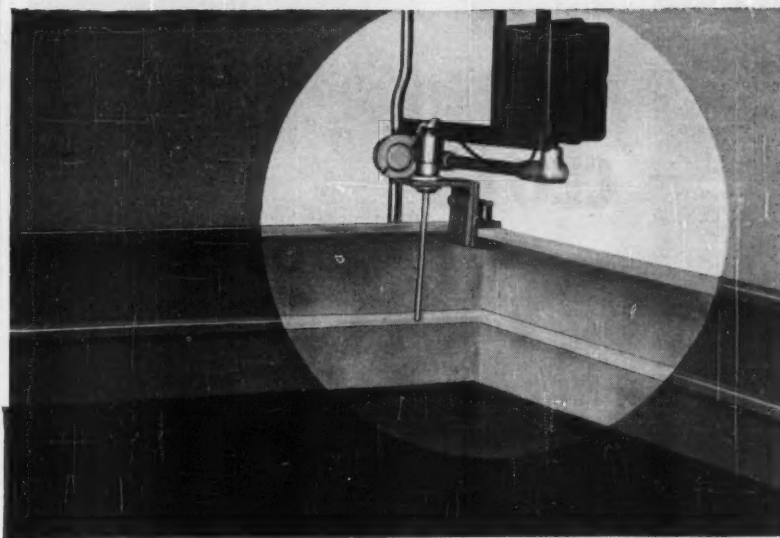
Mr. Karr, formerly manager of technical development, has been appointed vice president of the Pennsylvania Salt Manufacturing Co. of Washington, with headquarters at Tacoma, Wash. He started with the company 20 years ago in the experimental field of agricultural chemicals, later served Penn Salt's western subsidiary in such capacities as chief chemist, superintendent of the Portland, Ore., plant, technical supervisor and manager of agricultural chemicals.

J. L. McCurdy—Assistant manager of Dow Chemical Co.'s plastics production department. Dr. McCurdy will be in charge of Styron, saran, Ethocel, vinyltoluene and polyvinyl chloride operations at the Midland division.

Chester Stevens—Appointed to the newly created position of technical director in charge of new product development and laboratory research, Eaton-Dikeman Co., Filtertown, Mount Holly Springs, Pa.

W. K. MacCready—Returned to General Electric Co.'s manufacturing department at the Hanford atomic energy plant after an eleven months' assignment

TEKTOR Keeps Hershey Chocolate from Overflowing Open Tank

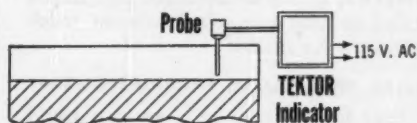


How to keep a 90,000 pound open milk chocolate storage tank from overflowing was the problem faced by the Hershey Chocolate Corporation.

Hershey Engineers found a solution by installing a Fielden TEKTOR High-Level Indicator Controller and Probe. Now, when chocolate level rises to 4 or 5 inches from the tank lip, this simple but dependable instrument flashes and sounds a warning so that the inflow of chocolate can be stopped.

Why TEKTOR Level Control is YOUR Solution

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- Electronically controls level as close as 1/16"
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- No moving parts . . . only one radio tube
- Regular plant personnel can maintain it
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A TEKTOR probe is installed vertically and its electrical capacity changes when chocolate level is 4 or 5 inches from the lip of the tank. This de-energizes the Indicator relay and switches on the warning light and alarm.



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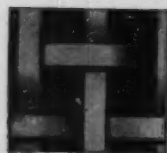
☐ Resistance Thermometer Recorder

☐ Proximity Meter

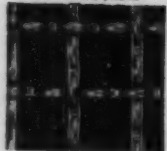
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COMPANY _____ ADDRESS _____

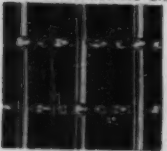
CITY _____ STATE _____



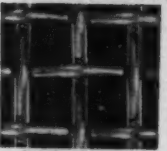
Flat Wire Mesh



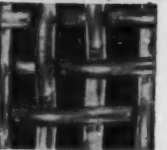
Double Intermediate Crimp



Single Intermediate Crimp



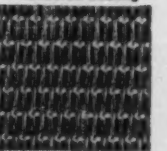
Double Crimped



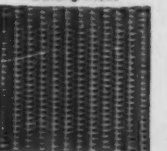
Twilled Weave



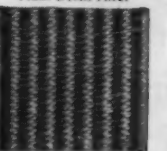
Calendered Backing



Oblong Mesh

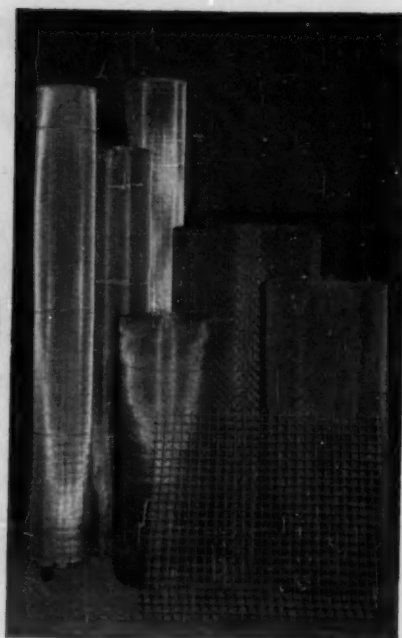


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OFFICES IN PRINCIPAL INDUSTRIAL CITIES

NAMES . . .

as manager of a special study that's now completed. Mr. MacCready is now manager of the reactor section in the manufacturing department.

Boleslaw Sienkiewicz—Project leader in engineering research at the central laboratories of General Foods, Hoboken, N. J.



M. H. Thornton

Dr. Thornton, one of the country's outstanding authorities in industrial and agricultural chemistry, has been named to the newly-created post of technical director of Midwest Research Institute, Kansas City, Mo. He has done research work in a wide scope of fields, including dehydrated foods, basic studies in fats and oils, development of analytical methods and identification of biologically important glucosides. In his new position, Dr. Thornton will supervise directly the work of the four divisions of the Institute, including physics, engineering, chemistry, research and chemical engineering.

Clifford Patch—Recipient of the University of Maine Pulp and Paper Foundation's Honor Award for 1955. Mr. Patch is technical director for the Eastern Corp., Bangor, Maine.

Morgan Jones—Plant manager of the new Acheson Dispersed Pigments (Texas) Co., subsidiary at Orange, Tex. Mr. Jones was formerly vice president and general manager of Wilson Organic Chemicals, Inc.

Walter A. Dean—Named to coordinate technological developments in titanium for the Aluminum Co. of America. Dr. Dean is chief metallurgist of the company's Cleveland, Ohio, works.

George F. Sharrard—Manager of R. M. Hollingshead Corp.'s technical service division.

Jerome Wilkenfeld—Assistant technical superintendent at Hooker Electrochemical Co.'s Niagara Falls, N. Y., plant. **John Van Vessem** has joined the operation department at the plant.

Fred B. Jacobson—Director of Industrial Sanitation Consultants, a new division of Vogel-Ritt Inc., with headquarters in Philadelphia, Pa.

Louis G. Helmick, Jr.—Vice president of manufacturing for Joy Manufacturing Co., Pittsburgh, Pa.

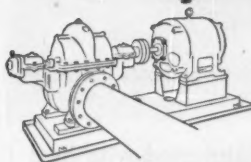
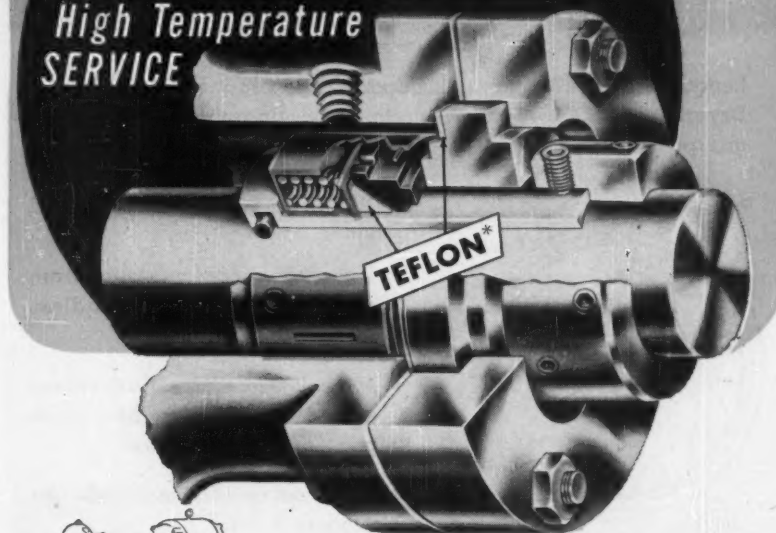
Otto Neracher—Technical superintendent of Laborterapica, S.A. of Sao Paulo, Brazil. Dr. Neracher was previously associated with Geigy Co. of Switzerland and with Hercules Powder Co.

R. J. Kiefer—District works manager in charge of Laclede-Christy plants at Bessemer, Ala.; Canon City, Colo.; Clearfield and Osceola Mills, Pa.; Ottawa, Ill.; factories No. 1 and No. 3 at the Laclede plant, St. Louis, Mo. **L. L. Cook**, district works manager, will be in charge of production of glass industry refractories and specialties, silica brick and vitrified clay pipe and drain tile.

William H. Burkhart—Elected president of Lever Brothers Co. **Jervis J. Babb** is chairman of the company's board of directors.

R. B. Fiske—Elected a board member of the National Industrial Conference Board for a term of one year. Mr. Fiske is vice president of American Cyanamid Co. Among the other elected board

A New PACKAGED SEAL FOR CORROSIVE and High Temperature SERVICE



easily installed in split-case pumps

This new addition to the "JOHN CRANE" family of anti-corrosive Type 9 Seals is the answer to a simplified means of seal installation (or removal) in modern split-case pumps.

Need for unbolting the upper half of the casing is eliminated, since the unit is mounted on a sleeve with an outside clamping ring.

Sealing members of DuPont Teflon readily adapt this seal to the handling of chemicals, solvents and corrosives, plus high temperature and similar conditions under which rubber cannot be used.

Springs and metal parts are furnished in the metallurgical specification best suited to the service.

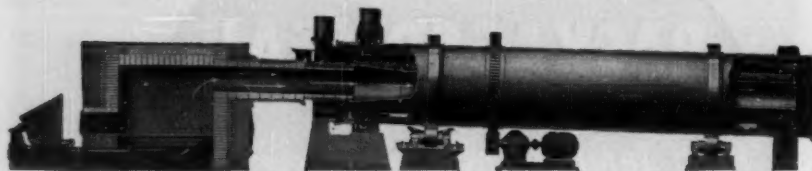
Wherever "hard-to-handle" liquids or gases are involved . . . temperatures from -90° to $+485^{\circ}\text{F}$. . . pressures to 750 psi . . . the "John Crane" Type 9 Seal is the seal for your pump.

Get complete facts and engineering data on the "John Crane" Type 9 Packaged Seal with outside clamping ring. Contact Crane Packing Co., 1809 Belle Plaine Avenue, Chicago 13, Ill. In Canada: Crane Packing Co., Ltd., 617 Parkdale Ave., N. Hamilton, Ont.

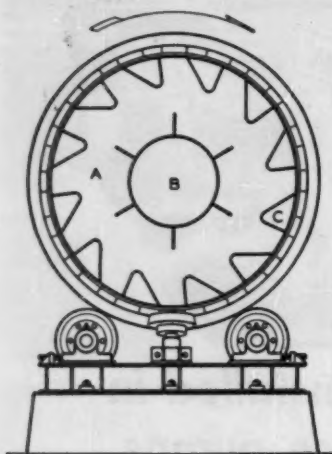
*DuPont Trademark



Ruggles-Coles **INDIRECT-FIRED** **DRYERS AND HEATERS**



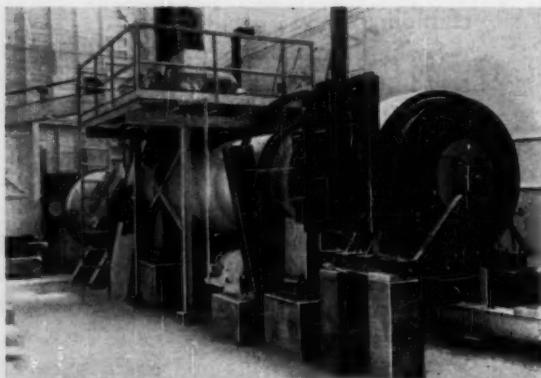
Lengthwise section through Ruggles-Coles Indirect-Fired Rotary Dryer. Note the complete isolation of drying chamber from hot gas passages.



Cross section of dryer. "A" is the completely isolated space in which the material is dried. "B" is the inner hot gas passage. "C" represents the V-ducts for the gas return.

ADVANTAGES of Indirect-Fired Dryers:

- Dry without contamination from combustion gases, regardless of fuel.
- Minimize auxiliary dust collection when handling fine precipitates and filter cake.
- Heat pulverized materials for process work.
- Collect vapors at high concentration.
- Available fabricated with heat and corrosion-resistant materials.



Ruggles-Coles Indirect Heat Dryer handling 200 mesh talc.

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NAMES . . .

members are Hobart C. Ramsey, chairman of the board, Worthington Corp. and J. P. Stewart, president of the De Laval Steam Turbine Co.

R. M. Love—Section head in the research and development division of Humble Oil & Refining Co.'s Baytown, Tex. refinery. D. C. Clark, Bartlett Johnston, J. T. Moody and W. K. Roquemore have advanced to the rank of senior chemical engineer at the refinery.

Benjamin S. Mesick—Senior staff member at Arthur D. Little, Inc. Dr. Mesick will handle the company's expanding activities in the titanium fabrication field and will explore the industrial uses for titanium.

John T. Connor—Vice president and general manager of Merck-Sharp & Dohme International Division of Merck & Co., Inc. Henry W. Gadsden succeeds Mr. Connor as administrative vice president of the parent company.

John Pitts—Works manager at the Fort Dodge, Iowa, plant of National Gypsum Co.

Arthur Minich—Elected president of Nuodex Products Co., Inc., a subsidiary of Heyden Chemical Corp. Kenneth C. Russell has been elected president of Nuodex International, Inc.

John C. Plummer—President and general manager of Lebec Chemical Corp. of Paramount, Calif.

Richard C. Wells—President of the newly-formed National Potash Co., jointly owned by Freeport Sulphur Co. and Pittsburgh Consolidated Coal Co.

John A. Wilson—Retired, after nearly 25 years with the Pittsburgh Plate Glass Co. glass division. Mr. Wilson was named a vice president of Pittsburgh Plate in 1947 and five years later assumed his duties as vice presi-

dent in charge of planning, purchasing and traffic in the glass division.

Rudolph A. Fenoglio—Assistant plant manager of the Maywood, Indianapolis, multiple plant operation of Reilly Tar & Chemical Corp.



Carl F. Prutton

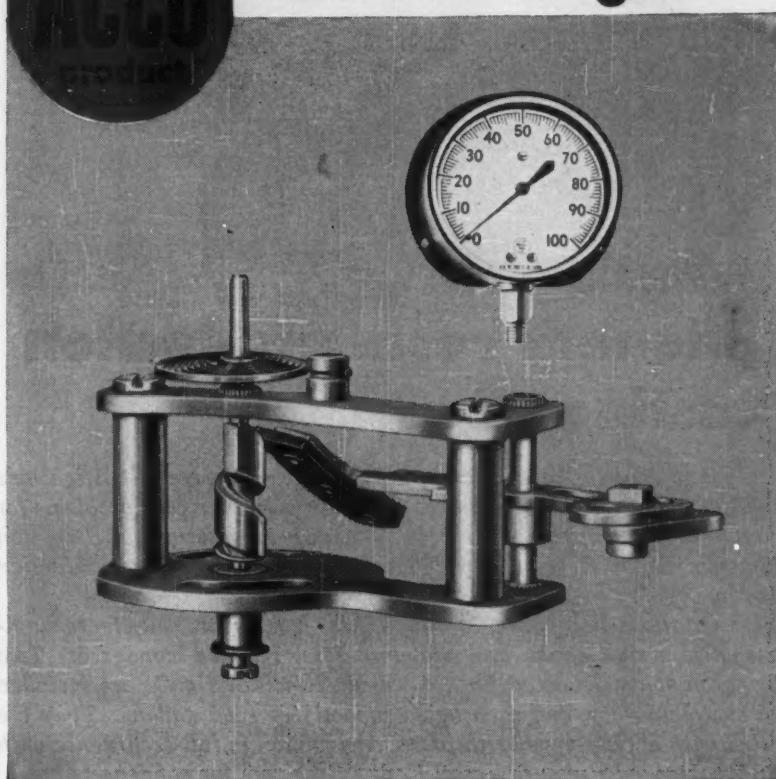
Dr. Prutton, vice president and technical director of chemical divisions, Food Machinery and Chemical Corp., was elected a member of the company's board of directors on February 28. Dr. Prutton has long been identified with the chemical industry, particularly in the fields of physical chemistry and chemical engineering, and holds more than 100 patents for lubricants and chemical processes and products. Prior to his becoming an executive member of FMC management, Dr. Prutton was vice president in charge of operations, engineering and research for Mathieson Chemical Corp. From 1942 to 1944 he was chief of the process development branch, Office of Rubber Director, and served as a consultant for the War Production Board, the Dow Chemical Co. and the Lubrizol Corp.

Jerry J. Craig—Elected treasurer of Sun Chemical Corp., Long Island City, N. Y.

Hal G. Johnson and Johan Bjorksten—Named to the board of directors of Tru-Scale, Inc., Wichita plastics firm. Dr. Johnson is director of the general develop-



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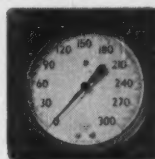
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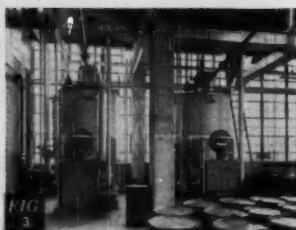
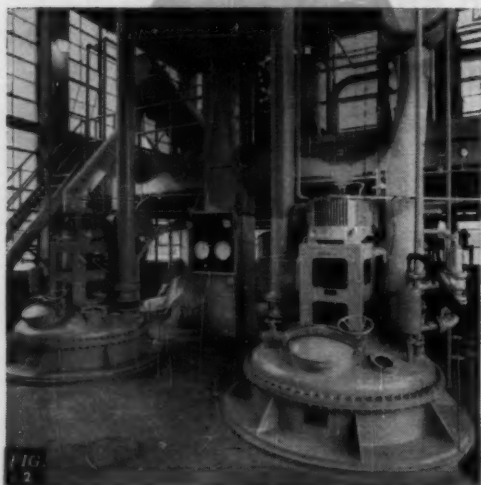
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On the balcony (Fig. 1) of this three-level arrangement, are stainless steel weigh tanks and stainless steel inclined condenser. Two Brighton steam-jacketed Phenolic Resin Kettles (Fig. 2) are installed on the main floor, and each has a capacity of 1500 gallons. They are fitted with anchor-type agitators. Construction in full accordance with ASME Unfired Pressure Vessel Code. Receivers for condensers are to rear of kettles, under balcony. Combination thinning and weigh tanks (Fig. 3) are below kettle floor and are connected to flush-type bottom outlets in kettle bottoms.



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designers and producers of chemical processing equipment

NAMES . . .

ment department, research and engineering division, Monsanto Chemical Co. Dr. Bjorksten is president of Bjorksten Research Laboratories, Madison, Wis.

Tom R. Ragland—Vice president of Union Carbide International Co.



Frank B. Huke

Mr. Huke has been appointed chief atomic products engineer of the refractories division of Norton Co. He's been associated with atomic development since he was a research assistant in the University of Chicago Metallurgical Project. Later he was a chemical engineer in the Manhattan District Corps of Engineers. Since the war, Mr. Huke has been associated with the Atomic Energy Commission as a technical assistant to the director of the production division, New York Operations Office. He joined Norton Co. in September 1954.

Clair Upthegrove—Named professor emeritus of metallurgical engineering by the regents of the University of Michigan.

Edwin O. Wiig—Appointed chairman of the chemistry department, University of Rochester. Dr. Wiig succeeds Dr. W. Albert Noyes, Jr. who has headed the department since 1939.

Hyman Chessin—Assistant director of research and development for the Van der Horst Corp., Olean, N. Y.

W. D. Willes—Product manager, Nordstrom valves, with headquarters in Pittsburgh, Pa. Mr. Willes was formerly general manager of Rockwell Manufacturing Co.'s Nordstrom valve plants at Barberton, Ohio, and Oakland, Calif.

Frank Perez—Assistant to the manager of Schering Corp.'s manufacturing subsidiary in Chile, Schering Compania Ltda., Santiago.

Arthur C. Greber—Assistant to the vice president of the manufacturing division at Smith, Kline & French Laboratories, Philadelphia, Pa.

Edmund R. Beckwith, Jr. and E. Roth Janes—Vice presidents of Warner-Chilcott Laboratories.

OBITUARIES

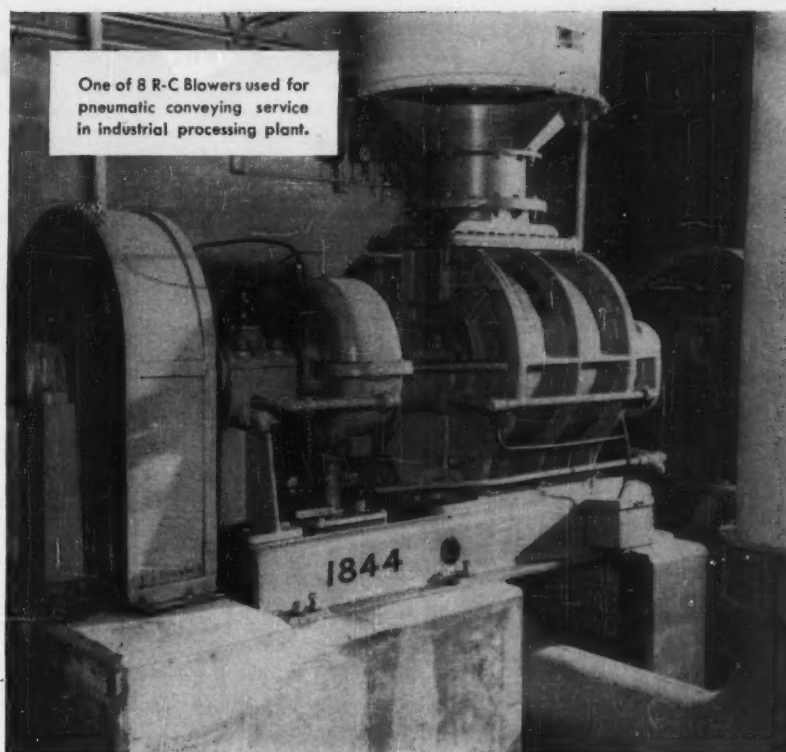
Oliver S. Ambrose, manager of the economics and petroleum analysis department of Tide Water Associated Oil Co., died in San Francisco, Calif., on February 15. He was 70 years old.

Thomas Sydney Quinn, co-founder and treasurer of Lebanon Steel Foundry, Lebanon, Pa., died in Miami, Fla., on February 20 after a lingering illness.

Samuel I. Aronovsky, 54, head of the pulp and paper section of the U. S. Dept. of Agriculture Northern Utilization Research Branch, died February 27. Dr. Aronovsky had been ill for several months.

Boyd H. Carr, Sr., 67, former head of pricing and chief statistician for Dow Chemical Co., died March 1 at Tucson, Ariz.

Robert J. Quinn, chemical engineer and former sales executive of Mathieson Chemical Corp. (now Olin Mathieson Chemical Corp.), died March 8 in Tucson, Ariz., after an extended illness. Mr. Quinn was 65 years old and had been living in retirement at Tucson since 1953.



One of 8 R-C Blowers used for pneumatic conveying service in industrial processing plant.

No failures in volume or pressure with R-C Rotary Positive Blowers

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In any needed capacity, from 5 cfm to 50,000 cfm, R-C Rotary Positive Blowers faithfully and accurately deliver their rated volumes and pressures. That's one most important reason for their wide use in industrial plants.

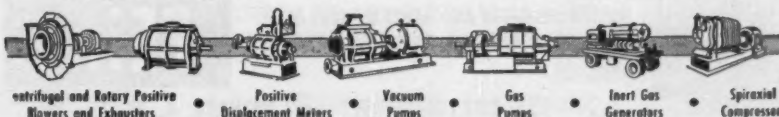
But there are other reasons, too, for the selection of R-C Blowers. The list of "BIG 4" essentials shows why sturdy R-C Rotary Positive Blowers have long been "standard" with thousands of purchasers.

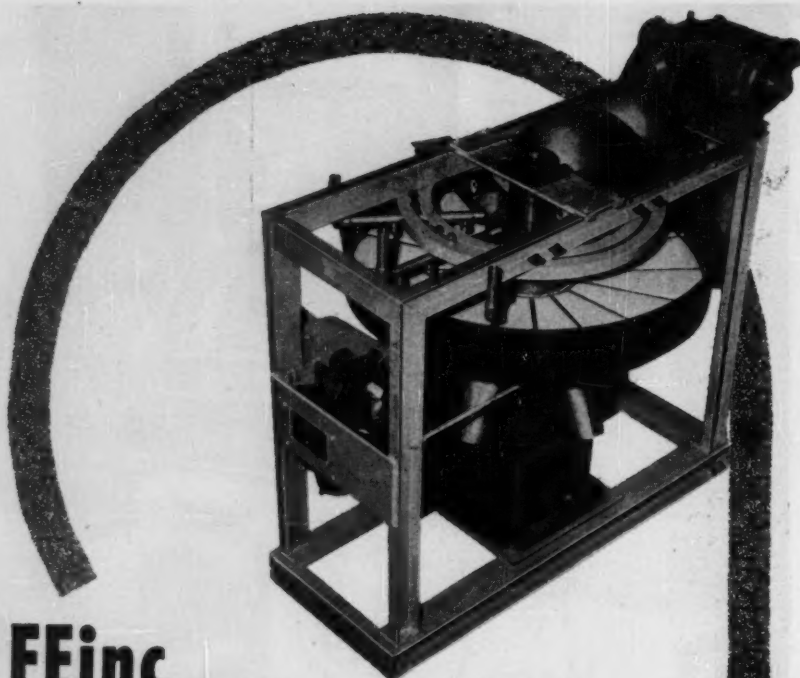
If you have a job of moving air or gas, call the R-C engineer. With a choice of Rotary Positive, Centrifugal and the new Spiraxial units, he can give you unbiased counsel and suggestions. Or, ask for bulletins on equipment for new installations or replacements.

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Ask for Bulletin

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TYPES OF CONTINUOUS FILTRATION EQUIPMENT

FEinc

41 155 ORATON STREET • NEWARK 4, N. J.

THIS MONTH'S

Letters:

Friction Factor

Sir:

An article in the January issue (p. 126) entitled "Predicted Pressure Drop Proved in Field" would have been more useful if the friction factor f had been defined. The one used is evidently not the one commonly used by chemical engineers because the values are about three times those given in Perry's Handbook. . . .

BARNETT F. DODGE

Dept. of Chemical Engineering
Yale University
New Haven, Conn.

► Confusion arose from the fact that the American Petroleum Institute has standardized on using a friction factor of $f=4f'$ where f' is the Fanning friction factor. According to our information, there also seems to be a trend among chemical engineers to swing to this larger factor.—Ed.

Basketful of Brickbats

Sir:

. . . were you trying to impress somebody with your promises (for 1955)? You didn't succeed in my case.

Before making promises, why not first do something about present shortcomings? For instance: typographical errors (I caught five in the January issue alone), sloppy editing and language you are frequently guilty of, fact-deficient descriptions of supposedly new plants and processes, superficial treatment of chemical engineering principles, scattering editorial articles throughout the ads so that both are difficult to read, articles that keep on repeating the same things . . .

I could go on and on. Instead, it is simpler and easier not to renew my subscription.

ERNEST ORMAND

Flushing, N. Y.

► Yes, we get our full share of brickbats, too. These serve the very useful (albeit painful) purpose of helping to keep up on our editorial toes.—Ed.

Pro & Con

More on Costs!

Sir:

... appreciate the four articles in your March issue on various aspects of costs and cost estimation. I found particularly useful the ones on costs of rubber-lined vessels (p. 191) by Lundeen and Clark and how to figure condenser costs (p. 116) by Allis-Chalmers.

I know your magazine has been a leader in publishing useful cost data for chemical engineers, and don't think for a moment that we aren't appreciative of it ... but what are the chances of getting more particularly on the many areas of equipment and operations that have not been covered at all?

LAURENCE L. WHITMORE
Process Engineer
Allied Chemical & Dye Corp.
Irvington, N. J.

► Good cost data—as you probably could guess—are not easy to come by! There are plenty of data existing—among private files. A surprisingly large percentage of it could be made available without revealing confidential know-how.

Are you able and willing to make a contribution? Something that would help chemical engineers throughout the process industries? If so, we'd like to hear from you!—Ed.

Heat Transfer Charts

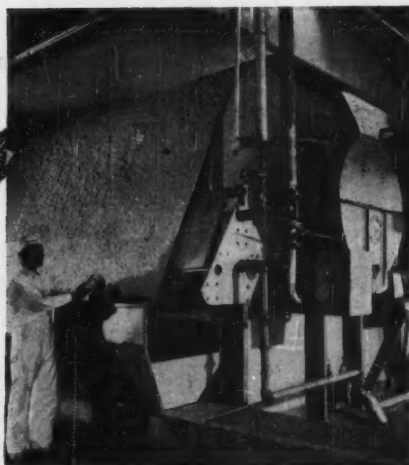
Sir:

Referring to the article "Heat Transfer Performance Curves" in your March issue, p. 187, I call your attention to an extremely informative and useful publication by the Czech professor F. Bosnjakovic (and co-editors): "Einheitliche Berechnung von Rekuperatoren," issued by the V. D. I.-Verlag, Dresden, in 1951 as a contribution to the V. D. I. research series.

This publication outlines in 40 pages the theory behind counter-flow and parallel flow, also cross-flow and so-called mixed cross-flow (as mostly encountered in gas-to-gas exchangers).

The booklet also shows convenient graphical methods to find

IN PECTIN EXTRACTION



One FEinc Continuous Filter Replaces Two Presses and Six Men

Looking at this clean, quiet picture, you'd never know this filtration job was formerly a hot, steamy mess, requiring six men per shift to load and unload wet, acid-laden press blankets, racks and press cars of two stop-and-go hydraulic presses.

Now it's a smooth-running, really continuous filtration operation, on this big FEinc String Discharge Filter. Only one operator is now required, with very little to do except watch the cake roll off hour after hour. Even the daily washup takes little time and effort.

Pectin recovery is reported to be as good as formerly. Losses due to leakage and spillage have been eliminated. The dynel cloth on this filter lasts more than a year ... a substantial saving in the cost of filter cloth.

The pulp is lifted from the filter by continuous orlon strings ... the famous FEinc String Discharge which successfully handles all types of cakes ranging from thin slimes to thick heavy sludges. There's no smearing, blinding or plugging of the fabric, and no loss due to "blow-back."

You too can improve production rates at lower cost in many of your filtration operations with the continuous ... really continuous ... FEinc String Discharge Filter. Find out more about what these versatile efficient filters can do for you. And ask about the new FEinc Horizontal Rotary Vacuum Filter for crystalline or fibrous pulps. Write today.

Ask for
Bulletin 103



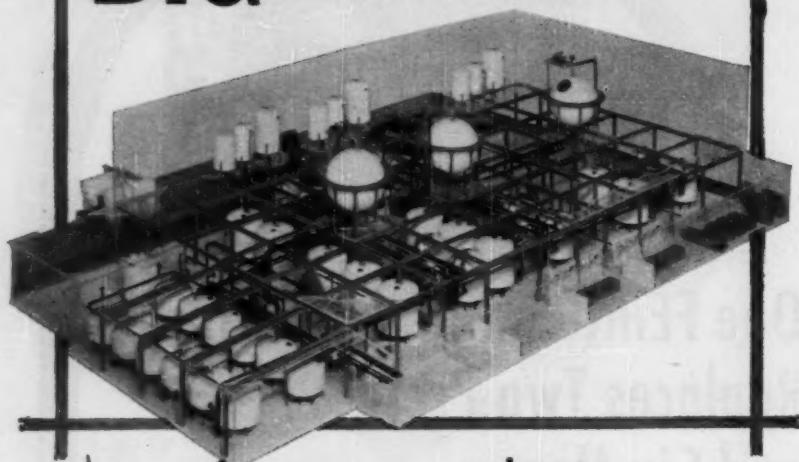
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TYPES OF CONTINUOUS FILTRATION EQUIPMENT

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155 ORATON STREET • NEWARK 4, N. J.

Model of **BIG** DEMINERALIZER EFFICIENCY



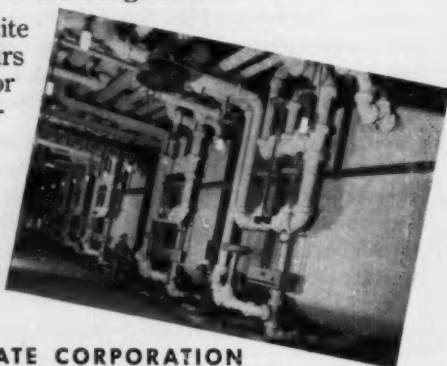
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BUILDING and operating a giant demineralization plant, like the one shown in model form above, are most impressive achievements. Unseen, yet vital, are the materials for which the whole plant is designed: the ion exchange materials used.

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PRO & CON . . .

temperatures at desired points along the heat transfer surface. It gives graphical methods for evaluation of complex systems of coupled heat exchangers and shows how to find intermediate temperature in such systems.

The publication offers an almost complete study of the subject dealt with in your March issue. . . .

J. RAASTAD

Norsk Hydro Sales Corp.
New York, N. Y.

► Many of our readers will be interested to learn of this Czech publication and of its convenient charts.

Irving Granet, author of our popular article in March on heat transfer performance curves, promises to come forth with more data and charts within a few months.—Ed.

You & Your Job

Sir:

Having subscribed to *Chemical Engineering* for the past two and a half years, I have particularly enjoyed the You & Your Job feature each month. During the past 18 months it has been especially valuable in enabling me to keep abreast of the employment situation. . . .

There is one problem confronting many engineers who enter the service directly from college; Upon separation from service, is it better to enter industry or to go back to college for graduate work?

Advantages and disadvantages either way are, in general, obvious. Yet many specific questions remain unanswered.

Does industry prefer to have a man with a Ph.D. at the expense of not having him for the three or four years it takes him to attain it? Would he be ahead in salary and position-wise at the end of ten years (other things being equal) if three of those years were spent in higher education?

Many similar questions may be asked, pertaining not only to the ex-serviceman, but also to any new graduate with an engineering degree. If, sometime in the next few months, an article dealing with this problem might be included in the You and Your Job section, it would

prove extremely valuable to myself and to others in a similar situation.

J. B. CROPLEY

U. S. Navy
San Francisco, Calif.

► Whether to take graduate study or not is an individual problem, and the decision must be made by the individual. Yet we do agree that a discussion of the advantages and disadvantages—and economics—could be useful.

YYJ's editor is now taking a hard look at the whole subject and its possibilities.—Ed.

Wanted: Practical Pointers

Sir:

You are to be congratulated on the feature articles that you are covering each month, and also for the handy arrangement which makes it possible to save these articles as one unit. The technical literature section is also very adequate.

In answer to your question as to the demand for future articles, such as refrigeration in the CE Refresher, my answer would be a very strong affirmative. This series is excellent.

Perhaps some similar features could be arranged involving technical calculations, such as the procedure for figuring pump sizes, etc., if there were a number of take-offs from a header being supplied by the pump. Perry's Handbook gives some of these technical calculations, which I find very useful in solving problems of a similar sort. The "old hands" could probably give us beginners some time-saving, practical pointers. What about it?

JAMES I. MERCY

Chemical Engineer
Jeffersonville, Ind.

► Here's a young engineer who challenges experienced engineers to be more liberal in passing along some of their time-saving, practical know-how. We repeat: What about it?—Ed.

We welcome short, pertinent letters from our readers giving their opinions on developments in the chemical engineering profession and in the chemical process industries. Address the Editor, *Chemical Engineering*, 330 West 42nd Street, New York 36, N. Y.



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WONDERFUL**

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compressed air or gas**

The Standardair Blower assures you of absolutely oil-free compressed air or gas. It delivers totally clean air or gas, thanks to a superior oil sealing arrangement.

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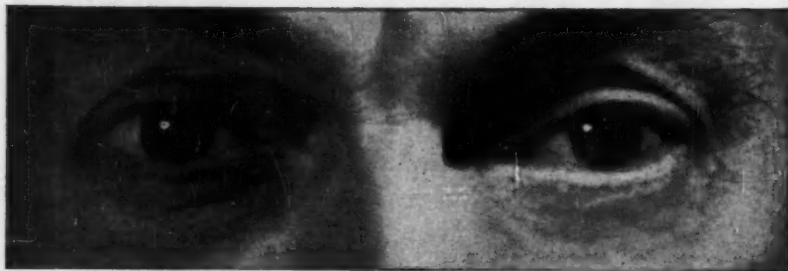
How? Through its exclusive cycloidal, screw type rotors which compress air in a modified adiabatic cycle. The air is taken in and discharged smoothly from pockets which form between the rotors.

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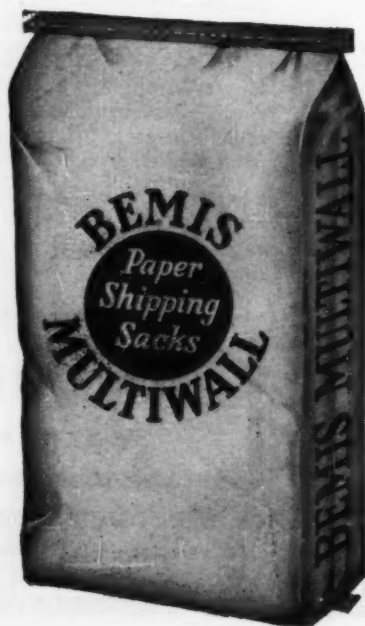
And you will know that Bemis color printing of brands on multiwall paper bags is bright, crisp, color-true . . . the kind that will boost the selling power of *your* brand.

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THIS MONTH'S

Technical

A Stereotyped Book Review¹

ENCYCLOPEDIA OF CHEMICAL TECHNOLOGY. Vol. 13: Stilbite to Thermochemistry. Edited by Raymond E. Kirk and D. F. Othmer. Assistant editors: Janet D. Scott and Anthony Standen. Interscience Publishers, New York. 952 pages. Subscription price \$25.

Once again it is our pleasure to bring to your attention another addition to the valuable² and growing³ series on your reference shelf.

The editors⁴ have again called on recognized experts⁵ for latest and best data. The entries⁶ cover a segment⁷ of current technological practice.⁸

As usual, chemical engineers will find several⁹ general survey articles¹⁰ that are well done. And again there

FOOTNOTES

1. This stereotyped book review is appearing here for the third time. It was prepared as a standard review for the eleventh and subsequent volumes of the Encyclopedia of Chemical Technology. It is reprinted to announce Vol. 13. Naturally, the footnotes again had to be modified somewhat. Look for it again in about six months.

2. See *Chem. Eng.*, Feb. 1948, p. 285, for an appraisal of the value of the series.

3. At a rate of about 1.7 volumes per year.

4. Kirk and Othmer (see *Chem. Eng.*, Feb. 1948, p. 285), Scott and Standen (see *Chem. Eng.*, May 1950, p. 261).

5. Eighty-five this time. (Vol. 11 had 80; Vol. 12, 70).

6. Only 49. (64 in Vol. 11; 53 in Vol. 12.)

7. Stilbite to Thermochemistry on the backstrip. Actual entries start with Stimulants.

8. Mostly American practice is reported. This accounts in part for the widespread interest and the many orders the publishers receive from other countries.

9. Eleven.

10. Stimulants, Surface Active Agents, Surgical Dressings, Surgical Sutures, Sweetening Agents, Tanning Materials, Tar and Pitch, Tar Sands, Textile Fibers (Synthetic), Textile Technology, Thermit Process.

Bookshelf

L. B. Pope

are entries which are too short¹¹ or too long.¹²

The articles¹³ discussing various industry segments¹⁴ are—on the whole—adequately presented and about the right length. Whole industries are covered with the usual attention to timeliness,¹⁵ accuracy¹⁶ and detail.¹⁷

Techniques¹⁸ are normally represented¹⁹ in this segment of the alphabet.[†]

A number²⁰ of the discussions are about arts and sciences²¹ which are of fringe interest to chemical engineers. These are, in some cases, extremely interesting reading.²²

Of major value are some of the articles in the largest²³ category—groups or families of compounds.²⁴ These are variable in length²⁵ as well as variable in intrigue²⁶ and

11. None.

12. Textile Technology.

13. Four.

14. Sugar Manufacture, Talc, Tall Oil, Tea.

15. "A novel process of refining cane sugar, which has passed the pilot-plant stage, consists of extracting the whole raw sugar with hot methanol."

16. "Teaseed oil must not be confused with the essential oil of the fermented tea leaf that helps to give black tea its flavor."

17. "The name [tall oil] is derived from the Sweish *tallolja* (literally 'pine oil') and was adopted after the term 'liquid rosin' had been prohibited under the Harrison Naval Stores Act."

18. Sugar Analysis, Sulfonation and Sulfation, Textile Testing.

19. Sulfonation is particularly good as a survey of current practice. Textile Testing is too long.

20. None in this volume.

21. Such as silvering in Vol. 12.

22. These interesting entries are missed.

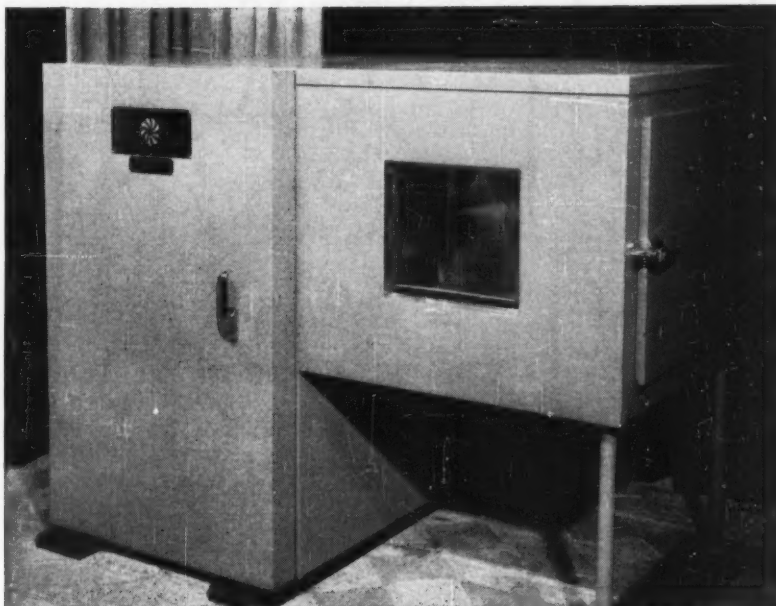
23. Twenty.

24. Strontium Compounds, Styrene Resins and Plastics, Sugars and Sugar Derivatives, Sulfa Drugs, Sulfides (Organic), etc.

25. Streptomycetes Antibiotics: 57.2 pages. Telomer: 0.3 pages.

26. "'Antabuse' . . . apparently affects the metabolism of alcohol in such a way that an accumulation of acetaldehyde in the blood poisons the patient, causing extremely unpleasant effects following the ingestion of alcohol."

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USES—to determine effects of controlled temperature and humidity conditions on test subjects of all kinds—to test processes—to find optimum conditions.

RANGE—With water and electric power services only, the range is from freezing temperature up to 150° F (dry bulb). With refrigeration, and using Niagara No-Frost Liquid to prevent freezing of sprays, you achieve dew point temperatures as low as minus 30° F. Control of relative humidity from 5% to 95% is obtained at all temperatures in this range. Air capacity is 200, 400 or 600 c.f.m.

METHOD—Air is saturated in the air-conditioning unit at the required dew point temperature and reheated to the desired dry bulb temperature. This is the method of the Niagara Type A Air Conditioner which has been proven for the most exacting duty over twenty-five years.

CONTROL—The dew point thermostat is located in the air stream, the dry bulb thermostat in the test cabinet. No moisture sensitive instruments are needed. Recorders may be used to obtain a complete record of conditions.

TEST CABINET—(inside) dimensions are 30" x 28" x 24" with access clear opening 26" x 22". Insulation is the equivalent of 4" cork.

AIR CONDITIONING UNIT is enclosed in an insulated cabinet adjoining the test cabinet. A door the full size of the cabinet wall gives complete access.

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BOOKSHELF . . .

variable in value²⁷ and in humor.²⁸

Single chemicals²⁹ are in the minority. But they are usually very well done.

27. "D-Glucose is dextrorotatory, D-fructose is levorotatory."

28. "In general, the medical use of thallium compounds has been limited probably to the vanishing point by their poisonous properties."

29. Six. This is no longer a minority. Three very important entries are: Styrene, Sulfur, Sulfuric Acid.

Recent Books Received

Abstracts of the Literature on Semi-Conducting and Luminescent Materials. Wiley. \$5.

Advanced Mathematics for Engineers. 3rd ed. By H. W. Reddick & F. H. Miller. Wiley. \$6.50.

Chemistry & Chemical Technology of Cotton. Ed. by K. Ward, Jr. Interscience. \$20.

Chemistry of the Pesticides. 3rd ed. By D. E. H. Frear. Van Nostrand. \$8.

Chemistry of the Soil. Ed. by F. E. Bear. Reinhold. \$8.75.

The Colloid Chemistry of Silica and Silicates. By R. K. Iler. Cornell Univ. Press. \$5.50.

Economics and Public Policy. By A. Smithies et al. The Brookings Institution. \$2.

Electroplating Engineering Handbook. Ed. by A. K. Graham. Reinhold. \$10.

Glass Reinforced Plastics. Ed. by P. Morgan. Philosophical Library. \$10.

Modern Gas Analysis. By P. W. Mullen. Interscience. \$5.50.

Organic Syntheses. Vol. III. Ed. by E. C. Horning. Wiley. \$15.

Paint & Varnish Manual: Formulation & Testing. By P. L. Gordon & R. Gordon. Interscience. \$3.50.

Patent Law in the Research Laboratory. By J. K. Wise. Reinhold. \$2.95.

Physicochemical Calculations. By E. A. Guggenheim & J. E. Prue. Interscience. \$7.

Plant and Process Ventilation. By W. C. L. Hemeon. Industrial Press. \$9.

Reagent Chemicals and Standards. 3rd ed. By J. Rosin. Van Nostrand. \$9.50.

Die Technische Electrolyse der Nichtmetalle. By J. Billiter. Springer. Vienna. \$16.40.

Thermodynamics. By R. L. Schweigert & M. J. Goglia. Ronald Press. \$6.50.

Thermodynamics of Irreversible Processes. By I. Prigogine. Charles C. Thomas. \$4.75.

Titanium in Industry. By S. Abkowicz et al. Van Nostrand. \$5.

Theory³⁰ is adequately covered.³¹ It is sometimes fascinating to discover facts outside one's own experience.³²

One entry³³ deserves special mention.

Reading or thumbing through this latest volume, one discovers strange facts,³⁴ learns queer things,³⁵ is often amused³⁶ and is frequently impressed with the erudition³⁷ of the authors. Pedanticism³⁸ is, of course, at a minimum.

It is a pleasure to recommend the series as a whole and this volume in particular.—LBP

30. Stoichiometry, Surface Properties, Temperature Measurement, Thermochemistry, Thermal Analysis.

31. Average: 12.8 pages each.

32. "The thermal differential method of course does not supplant . . . other methods of analysis; it is an additional tool and should be a part of every research and control laboratory dealing with minerals."

33. Telomer. This unsigned entry is hardly more than a definition.

34. "Mammals resort to D-glucuronic acid in the detoxication of phenols and other aromatic compounds."

35. "Modern catgut is usually obtained from the submucous connective tissue of the small intestine of healthy sheep."

36. "Such sponges [containing glass fibers or barium sulfate] may be detected by x-ray equipment if left in the patient after an operation."

37. "Potassium fluotantalate was produced first by Berzelius in 1825 and is most important salt of tantalum today."

38. "Suppositories and punctured capsules are administered rectally."

Telegraphic

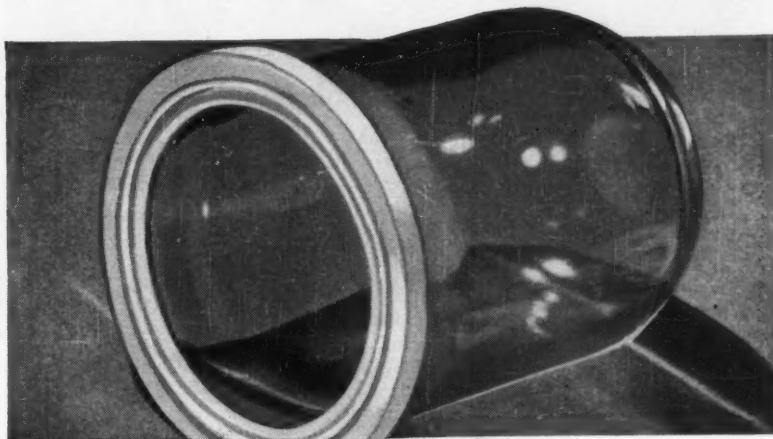
PHYSICO-CHEMICAL CALCULATIONS. By E. A. Guggenheim and J. E. Prue. Interscience Publishers, New York. 491 pages. \$7.

Reviewed by F. C. Nachod

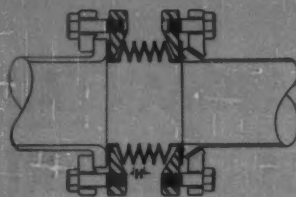
The most elegantly designed experiment and the best collection of data will be of no consequence if the ensuing mathematical treatment consists of inept, illogical and incorrect calculations. To prevent this, Dr. Guggenheim, the well-renowned thermodynamicist, and Dr. Prue have devised a terse book

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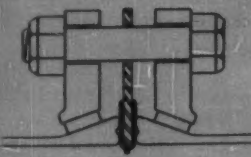
MADE OF
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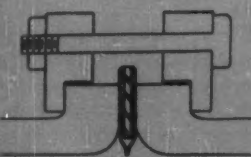
ABOVE: Chemiseal Snap-on Gaskets, molded of TEFLON to match contour of conical end glass pipe, assure perfect automatic centering of joints and free flow of materials. For all standard pipe sizes from 1/4 in. to 6 in.



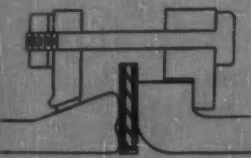
AT LEFT: Chemiseal Expansion Joints and Flexible Couplings absorb shock and vibration, thermal expansion and contraction. Correct misalignment. Connect unlike piping ends and nozzles.



Chemiseal TEFLON-Jacketed Gaskets, standard for Corning conical flanges. Seal at low bolt loads. Sizes from 1 in. to 6 in.



Chemiseal TEFLON-Jacketed Gaskets. Compressed asbestos sandwiched between woven asbestos inclosed in a TEFLON envelope. Ideal for glass-lined steel connections. Seal at low bolt loads.



Chemiseal Adaptors provide a safe, tight seal between unlike piping ends and nozzles. A steel bearing ring provides rigidity. Resilient core assures positive seal. TEFLON Jacket protects and contains easy-to-handle single unit.

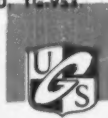
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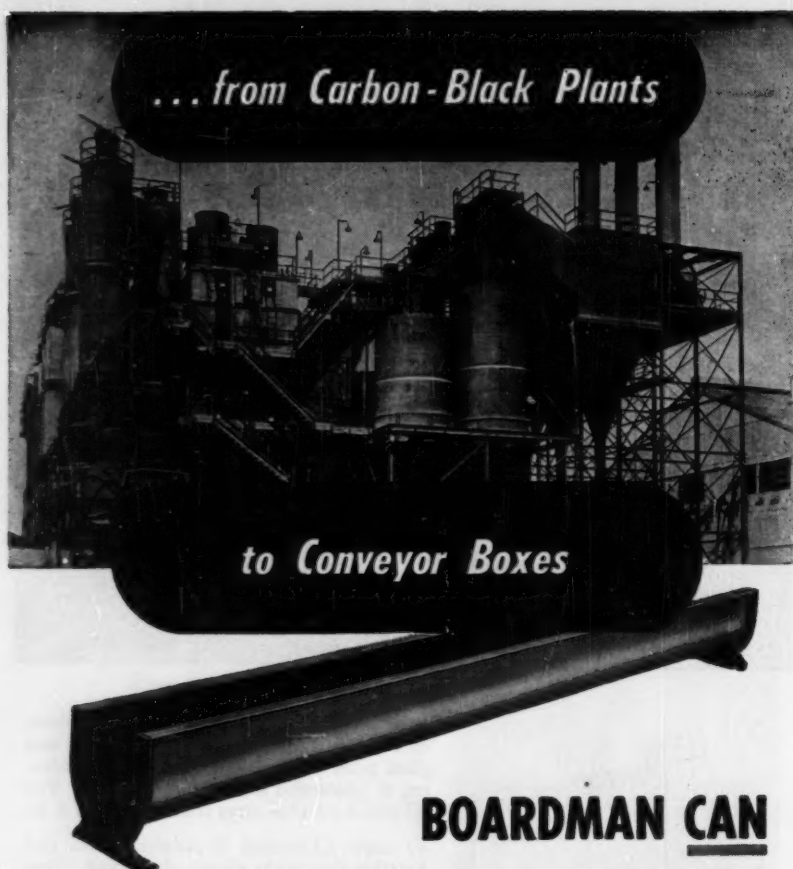
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BOOKSHELF . . .

entitled "Physicochemical Calculations." They have analyzed 23 delineated fields of pursuit and constructed or used data from the literature for model calculations. Each of these 171 examples is treated in the same well-organized fashion under the captions: "object," "data," "introduction," "calculation," and "discussion," and is of almost telegraphic brevity.

The great didactic value of this book is apparent and it should make a streamlined text for instruction of chemistry and chemical engineering students. Likewise, investigators who have strayed from the straight-and-narrow path of rigorous mathematics will find it a salutary remedy of their shortcomings.

Specific Applications

INDUSTRIAL DETERGENCY.

Edited by William W. Niven, Jr. Reinhold Publishing Corp., New York. 340 pages. \$8.75.

Reviewed by E. S. Garverich

Here is a book by a group of experts in their fields on the why and how of industrial cleaning designed primarily for those directly associated with cleaning operations. It is a fitting companion book to Mr. Niven's earlier work "The Fundamentals of Detergency" which presents the principles of detergent action. This book covers the composition of detergents for specific applications and the determining factors in the choice and use of the proper detergent for particular cleaning operations.

After a description of the more important detergent materials, including their properties, uses and limitations, the book covers cleaning operations in the following fields: Laundry, Drycleaning, Textile Processing, Foods and Beverages, Dairy, Dishwashing, Metals Industries and General Industrial Cleaning. In each field the authors describe the methods, materials and equipment used, as well as problems that arise and how they are overcome. Most of the newer developments in each particular field

are included along with probable future trends.

Far too little space in the book has been allotted to the metals industries with its wide variety of cleaning operations and, consequently, only the high spots are touched upon. This rapidly expanding field with its ever increasing potential for detergents could well have been discussed in greater detail.

High Caliber

PHYSICAL METHODS OF ORGANIC CHEMISTRY. Vol. I, Part 3, Edited by A. Weissberger, Interscience Publishers, New York. Pages 2,097 to 2,530. \$8.50.

Reviewed by F. C. Nachod

Ever expanding like Eddington's universe, the well-known and well-received Weissberger series is growing and stretching. The present part three consists of an expansion, rejuvenation, and addition to the two parts of the second edition of Vol. I and contains a lot of new and excellent material. The contributors, Drs. Blout, Bonnor, Brockway, Corliss, Dailey, Hamm, Harker, Hastings, McGoury, Mark, Powles, Selwood, Signer and Smyth, cover a lot of ground. To name just a few fields: electron microscopy, magnetic susceptibility, viscometry of high polymer solutions, radio-frequency spectroscopy and scintillation counting.

This expansion is of the same high caliber as its companion volumes and can be recommended without reservation to all.

Excellent Job

PATENT LAW IN THE RESEARCH LABORATORY. By John Kenneth Wise. Reinhold Publishing Corp. 145 pages. \$2.95.

Reviewed by Melvin Nord

This inexpensive little book is one of the series of Reinhold Pilot Books and, as such, is an unqualified success. It accomplishes its ob-

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The COMPLETE line of
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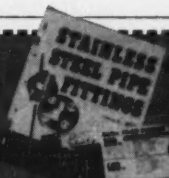
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BOOKSHELF

jective of advising research men as to the way in which patent law affects them in their work, and it also accomplishes its objective of doing this in a brief, practical, and inexpensive way.

Among the high spots in the book are the discussion of property rights in patents and the importance and proper way of keeping laboratory records for patent purposes.

The book is thoroughly up-to-date, being based on the Patent Act of 1953. From this aspect the book has an advantage over earlier books, and the advantage is fully realized by the author. For this reason alone, it is safe to say that this book is likely to and deserves to find a place in every well-organized research laboratory. Even aside from this, however, the book can stand on its merits and is certain to prove of considerable value to technical personnel and executives.

The author and publisher are entitled to and are hereby tendered hearty congratulations for an excellent job, well conceived and well executed.

Frontier

THE KINETIC BASIS OF MOLECULAR BIOLOGY. By Frank H. Johnson, Henry Eyring and Milton J. Polis-sar · John Wiley & Sons, New York. 874 pages. \$15.

Reviewed by F. C. Nachod

The co-operative effort of three professors from Princeton, Utah and San Francisco is an ambitious project and a monumental document. They have tried and succeeded in putting numbers and exact mathematics to work on the elusive processes which constitute

Building up files?

Then you can cash in right now on our new, comprehensive Guide to Technical Literature in this issue. There you'll find a checklist of the current and latest literature on any topic in your field—easy to get, too.

biology. After laying a firm (though abbreviated) foundation by expounding classical and quantum mechanics, they proceed to tackle problems such as the role of temperature and pressure on life, membrane diffusion, nerve impulse transmission and muscle contraction.

As all frontier-expanding books, the present one is not free from errors, and several minor typographical slips. They are, however, few in proportion to the size of the text, which can be warmly recommended to graduate student, teacher, and researcher, alike.

Europe's Chemical Engineering Catalog

Chemical engineers and others who will attend theACHEMA exhibition and international chemical engineering congress in Frankfurt May 14-22 will receive copies of the newACHEMA Jahrbuch 1953-1955. This handsome, cloth-bound, 900-page volume is a most comprehensive catalog of European developments in process equipment, materials of construction, instruments and other chemical plant accessories.

This first venture in publishing a tri-lingual work (in German, French and English) is largely due to the enterprise of its editor Dr. Herbert Bretschneider, managing director of Dechema (Deutsche Gesellschaft fuer Chemisches Apparatewesen), and one of the founders of the European Federation for Chemical Engineering.

Representatives of practically all of the 23 member societies have contributed brief accounts of technical achievements in the principal European countries. Newly developed process equipment is discussed in detail in 125 pages of editorial-type advertisements of the interested firms. The remainder of more than 400 pages is devoted to alphabetical lists of European suppliers for chemicals, construction materials, and process equipment, lists of European trade names and general information on chemical suppliers.—SDK

Mass spectrometry on a practical industrial basis

Two companion instruments, Types 21-610 and 21-620, now extend the speed and accuracy of mass spectrometric analysis from the laboratory out into the plant. Flexible and simplified, needing only 115 volts and a small supply of cooling water, the twin instruments are easily adaptable to process-stream monitoring, batch work, or leak detection.



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TYPE 21-610 is moderately priced and a truly general-purpose instrument. Although primarily designed for continuous petroleum and petrochemical stream analysis, it is also valuable as a production-line leak detector or laboratory analytical instrument. It has been used in applications ranging from on-the-spot acetylene-plant monitoring to hospital clinical tests on lungs.

TYPE 21-620 has the highest mass range of any instrument in its compact size range. Using the newly developed "Cycloidal Focusing" principle for analysis, it goes beyond the 21-610 for accurate readings from mass 2 to mass 150. Medical laboratories, petro-chemical plants and general research organizations will all find it an ideal answer to their analytical problems.

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The 21-610 may be converted to a 21-620 whenever the latter's greater resolving power is needed. The work is accomplished by a CEC Field Service Engineer without return of the instrument to the factory. Involving primarily the exchange of some components and the addition of certain others, the conversion is made reasonably and quickly.

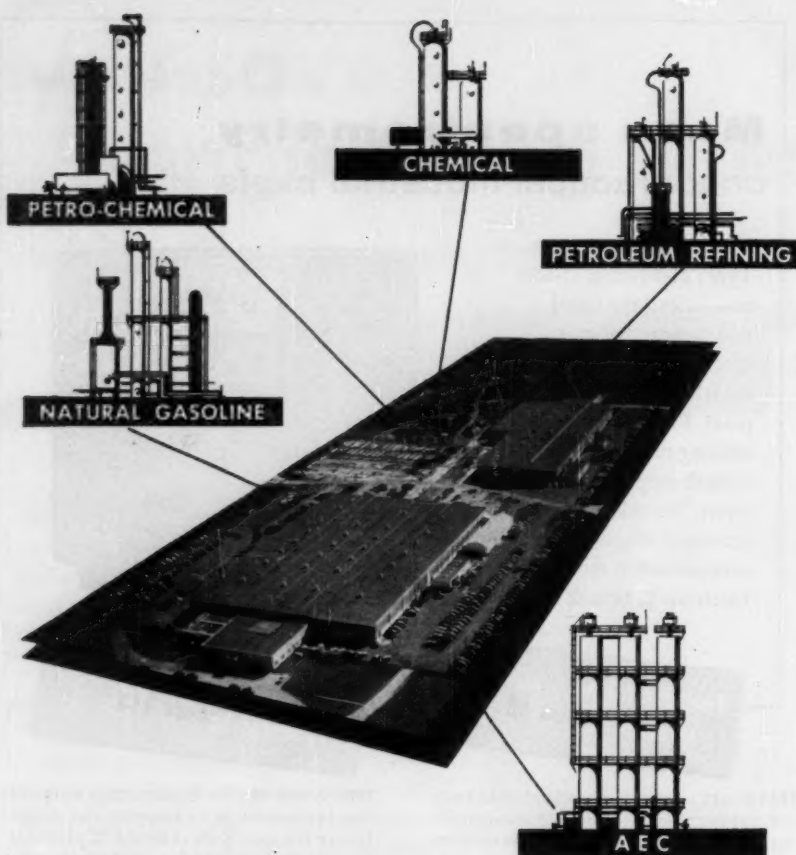
An extensive accessory line greatly broadens the utility of both the 21-610 and 21-620. Automatic peak selectors scan as many as six mass numbers on a repetitive cycle; sampling probes and magnet shunts make either instrument a practical production-line leak detector; batch-sample inlet systems and continuous-chart recorders (left) may be mounted directly on the instruments.

How industrial mass spectrometry can be used in *your* business is explained in Bulletin CEC 1824A-X16. Send for your copy.

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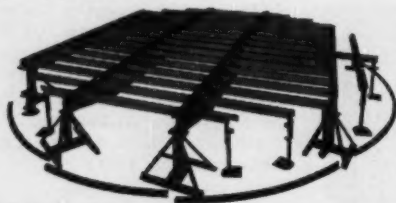
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THIS MONTH'S

Recent Books

Dissatisfaction

There is no need for dividing engineers and managements into separate "armed camps." From a study of the major causes of dissatisfaction among engineers in industry, the National Society of Professional Engineers suggests a series of remedial actions by management and individual engineers in the fields of professional status, employment conditions and economic status. 124 pages.

"A Professional Look at the Engineer in Industry." National Society of Professional Engineers, 1121 15th St., Washington 5, D. C.

Unsteady

The field of nonsteady gas flow is barely established as an important branch of fluid dynamics. This text is a consistent set of computing procedures that will cover most of the problems that ordinarily may be encountered. 278 pages.

"Wave Diagrams for Nonsteady Flow in Ducts." By G. Rudinger. D. Van Nostrand Co., 250 Fourth Ave., New York 3, N. Y. \$6.

Molecular Vibrations

Purpose of this book is to develop elements of theory toward a consistent system for analyzing experimental data. Understanding the mathematical techniques will enable the user to extend and adapt them to new problems. 388 pages.

"Molecular Vibrations, the Theory of Infrared and Raman Vibrational Spectra." By E. B. Wilson, Jr., J. C. Decius and P. C. Cross. McGraw-Hill Book Co., 330 W. 42 St., New York 36, N. Y. \$8.50.

Patgrams

A new patent publication is in the offing. The weekly publication will offer a unique service: patent disclosures are diagrammed for fast scanning but they still contain es-

& Pamphlets

sentially every detail. The approximately 100 chemical patents issued every week will be offered in diagram or "Patgram" form.

"Chemical Patgrams." Published by F. C. Philpitt, Box 5559, Washington 16, D. C. \$100 per year.

Chromatographic History

A classic of chromatography—that's the description of the 1903 paper which has been translated and annotated. 35 pages.

"Michael Tswett's First Paper on Chromatography." By G. Hesse and H. Weil. Available from Alupharm Chemicals, 54 C St., Elmont, L. I. N. Y., \$2.

American Science

The annual report from the National Science Foundation discusses current aspects of American science and outlines program activities of the NSF. 138 pages.

"Fourth Annual Report of the National Science Foundation." Superintendent of Documents, Washington, D. C. 50¢

Pulp & Paper

Here's an annotated bibliography of the literature on pulp and paper manufacture published during the year 1953. 520 pages.

"Bibliography of papermaking and U. S. Patents, 1953." Compiled by W. B. Weber and J. Weiner. Technical Association of the Pulp and Paper Industry, 155 E. 44th St., New York, N. Y.

Registration

Here's a compendium of registration laws for professional engineers in the 48 states, Alaska, Hawaii, Puerto Rico and the District of Columbia. 614 pages.

"Professional Engineering Registration Laws." By A. L. McCawley. Trustee Publication Fund, Jefferson City, Mo. \$8.75.

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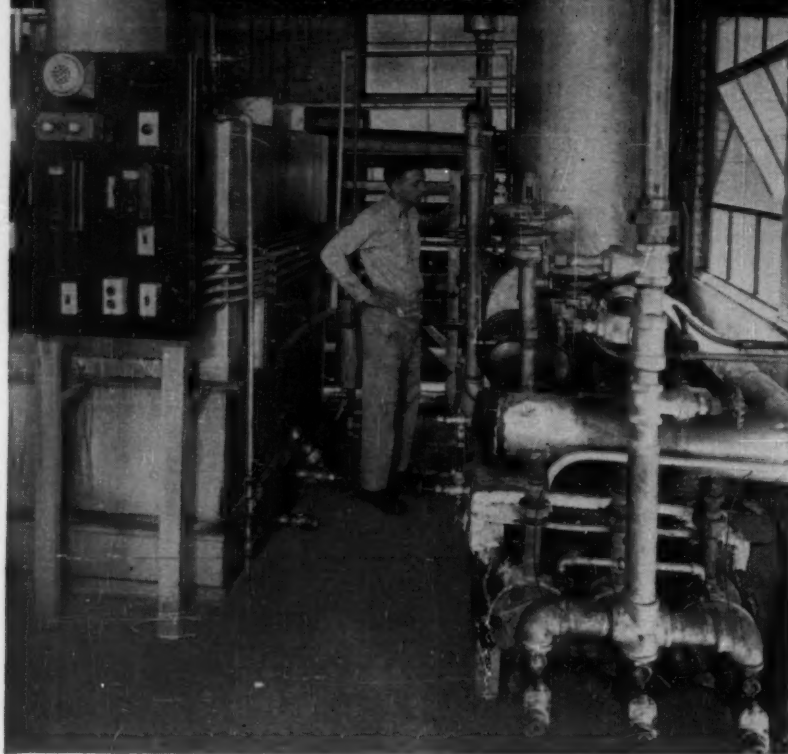
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• A few years ago Armour & Co. purchased a Gas Atmospheres' Nitrogen Gas Generator for use in their McCook Chemical Division installation. Today they're glad they did.

The reason: the use of nitrogen gas has been on the constant increase and the Gas Atmospheres' unit has met these greater needs unfailingly. Because of variable demand, they're now considering adding storage facilities in order to get even greater utilization from the units.

Some of the many Armour uses: flushing thousands of feet of lines where steam or air would introduce water or oxygen into the product; blanketing acetone; purging hydrogen gas production unit; for the gaseous element in manometer operation.

Armour engineers working with the unit, which is equipped with both refrigerant and chemical dryers, say it is a most dependable piece of equipment.

If you want long-term results like these, it will pay you to talk today with a Gas Atmospheres' engineer.

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equipment for producing industrial gases

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THIS MONTH'S

Firms in

New Lines

The Arthur G. McKee Co., industrial construction firm has expanded into the chemical and non-ferrous metals fields.

New Representatives

The Dravo Corp., Pittsburgh, has been appointed exclusive distributor of the Paracoil heat transfer equipment of the Davis Eng. Co.

Carboloy Dept. of General Electric Co., Detroit, has named the McKee Tool & Supply Co., Lima, O., as a distributor.

R. M. Hollingshead Corp., Camden, N. J., has appointed the Brandon Equipment Co., Chicago, as distributor of Hollingshead products.

Lehigh Chemical Products Co., Chestertown, Md., has appointed two new agents: Industrionics, Inc., and the Edco Sales Co., Inc.

Cleaver-Brooks Co. has selected the Ruffridge-Johnson Equipment, Inc., Minneapolis, as agent for its boiler equipment.

Parker Appliance Co., Cleveland, has named the Louis H. Heim Co., Baltimore as distributor of Parker tube and hose fittings.

Barrett Div., Allied Chemical & Dye Corp., has selected Cole & DeGraf to service and sell its "Cumar" resins in San Francisco.

Dunton Processes, Inc., New York, has appointed Rawson & Co., Houston, as its representatives.

Automatic Switch Co., Orange, N. J., has named the Moorland Co., No. Kansas City, Mo., as agent for ASCO solenoid valves.

The Graver Water Conditioning Co., New York, has appointed the Frontier Eng. Services Co., Salt Lake City, as a representative.

the News

M. A. Gibbons

Beech-Nut Packing Co. has selected the Sheffield Chemical, Inc., Norwich, N. Y., as sales agent for the sale of its polyvinyl acetate resins.

Copes-Vulcan Div., Erie, Pa., has appointed the Central Pump & Equipment Co., St. Louis, Mo.

Minerals Processing Co., La Grange, Ga., has appointed the Roger G. Brown Co., Macon, Ga., as exclusive agent.

Fielden Instrument Div., Robertshaw-Fulton Controls Co., has appointed the H. J. Klug Co. a sales representative.

Eco Eng. Co., Newark, N. J., will make its line of positive displacement rotary type pumps available through the sales offices of Fischer & Porter Co., Hatboro, Pa.

Electric Regulator Corp., Norwalk, Conn., has appointed Sheridan Associates, Cincinnati, Ohio, as sales representative.

No. American Philips Co., Inc., Mt. Vernon, N. Y., has appointed the Industrials Controls Inc., Tulsa, Okla., as a distributor.

New Locations

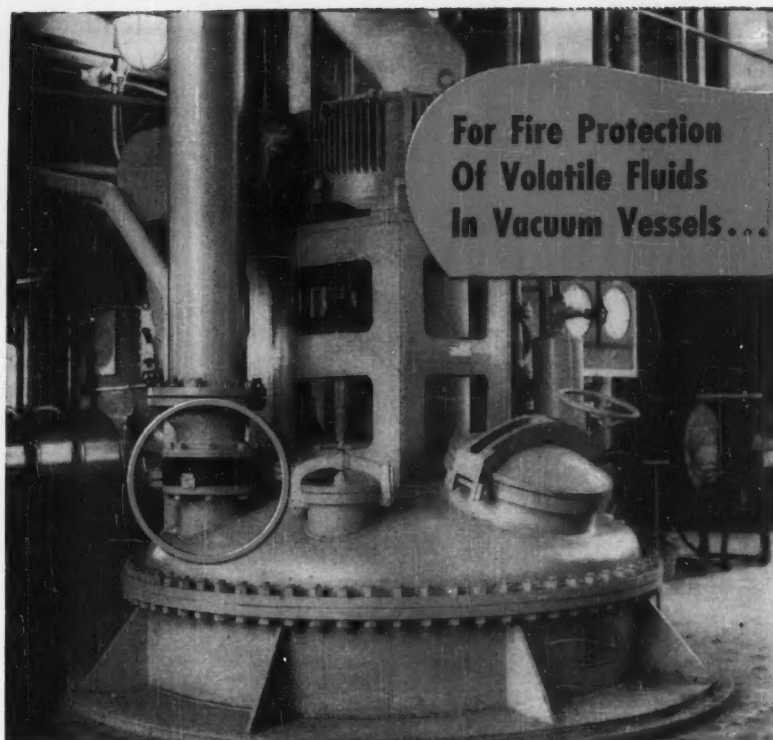
Michigan Pipe Co. has transferred its operations from the former Bay City location to the new plant in Gagetown, Mich.

Permacel Tape Corp., New Brunswick, N. J., manufacturer of industrial tape, has moved its Texas Div. offices to Dallas.

Atlas Powder Co. has transferred its eastern district explosives sales headquarters from New York to Wilmington.

New Companies

Silicone Seals, Inc., Chicago, will engage in the design and production of silicone rubber hermetic terminals.



The Formica Company Uses BS&B SAFETY HEADS!

In the Formica Company's Evendale, Ohio, plant are four large high-vacuum vessels used for the impregnation of basic raw material with resins and varnish. These substances are, of course, even more volatile in a partial vacuum than at atmospheric pressure, and a single spark could set them off.

To protect each vessel from explosive destruction in case ignition of its contents *does* occur, an 8-inch BS&B SAFETY HEAD is utilized. This SAFETY HEAD acts as a *controlled* weak spot in the vessel, and would fail *safely*, with minimum danger from fire, at a lower pressure than the vessel itself.

Future plans of the Formica Company call for additional resin processing vessels, and they too will be protected with BS&B SAFETY HEADS!

If you aren't already using BS&B SAFETY HEADS in *your* plant to safely handle pressure relief problems, we'd suggest you get in touch with your nearest BS&B Representative without delay. Or, write for Catalog and full information...no obligation!



THE "CIRCUIT-BREAKER" OF Pressured Systems

For Better Regulation of Pressures, Temperatures, Liquid Levels or Flow, Equip Your Process with BS&B AUTOMATIC CONTROLS!



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The new Chempro mechanical seal can be installed in only 20-30 minutes—it requires no special holding clamps or machining of stuffing box faces. It is completely interchangeable with stuffing box packing.

Chempro seals give highly economical service on pumps handling acids, caustics, solvents and other chemical liquids and slurries under a wide range of operating conditions. It has been successfully used under slurry conditions that previously could not be sealed by a mechanical seal.

The seal faces rotate within the confines of the stuffing box, eliminating the hazard of dangerous sprays in handling corrosive, toxic, explosive and flammable materials.

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FIRMS . . .

Calvert City Chemical Co. has been formed by Pennsalt, as a wholly-owned subsidiary, to supply acid grade fluorspar for its fluorine chemicals plant.

Crestwood Chemical Co. has been organized with an authorized capital stock of \$1,000.

A. A. A. Ammonia Service, Inc., has been formed with an authorized capital stock of \$100,000.

H. E. Charlton Engineers Ltd., chemical specialists firm has been organized in London.

Yale Rubber Mfg. Co. of Canada, Ltd. has been formed upon the establishment of a plant in Kincardine, Ont., Canada.

Northwest Nitro-Chemicals, Ltd., will manufacture and market high analysis nitrogen and phosphate chemical fertilizers.

Herrick-Bradley Eng. has been established to specialize in the field of pipe fabrication, in Norwalk, Calif.

Caribbean Oil Refining Co. will be set up in San Juan, Puerto Rico; it will be one of the largest industries established there.

New Facilities

Witco Chemical Co. has acquired a half interest in the Ultra Chemical Works, Inc., Paterson, N. J. detergent manufacturer.

American Air Filter Co., Inc., has opened a branch office in Denver.

American Oil Co., Yorktown, Va., has awarded a contract for a 35,000 b/d refinery to the M. W. Kellogg Co.

Olin Mathieson Chemical Corp. will soon complete its new roll bond plant at East Alton, Ill.

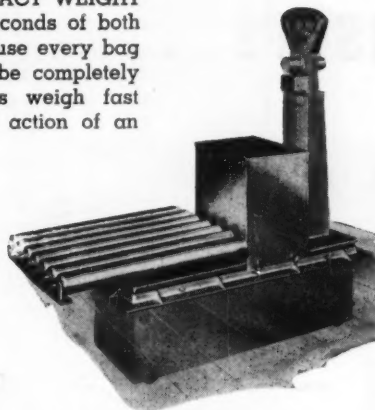
Nuclear Development Associates, Inc., has purchased the Consolidated Edison Co. property in White Plains, N. Y.

Nat'l Lead Co. has acquired the capital stock of the So. Screw Co., Statesville, Ohio.



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Right on your conveyor line, this EXACT WEIGHT Scale gives an accurate check in seconds of both open-end and valve-type bags. Because every bag is checked, costly over-weights can be completely eliminated. EXACT WEIGHT Scales weigh fast because of short lever fall and the action of an adjustable hydraulic damping device. They read fast, too, because of high-ratio visible indication. Model 1302-R can be installed on the floor or recessed into the floor, as shown. Also available with round commodity platter instead of rollers, or with sack rest. Write for details.



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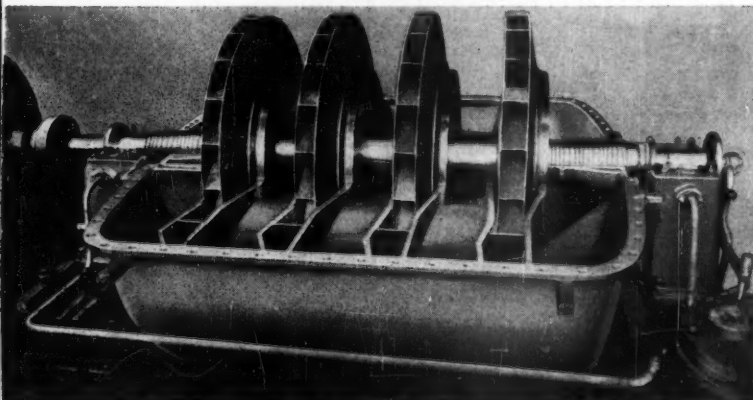
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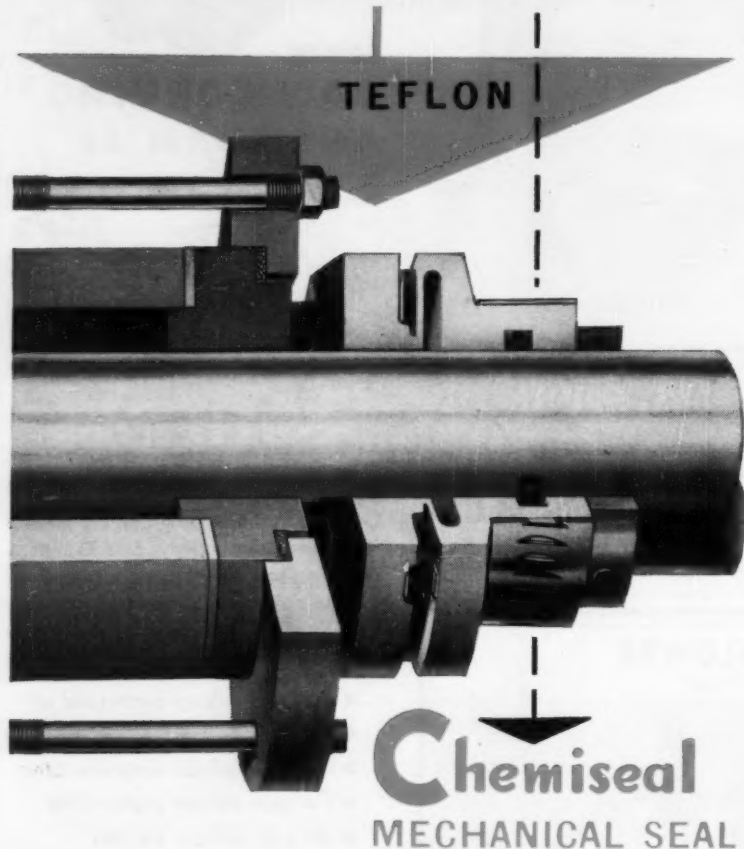
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Three years of actual field experience has proven it—handling acids, alcohols, alkalies, hydrocarbons; clear, abrasive and tarry materials.

Features: Seal rotates with shaft. Only bearing surface is between precision ground rotating and stationary faces. Combines chemically impervious TEFLON with a balanced bellows design.

Low friction load on shaft. Lower power cost.

No scoring of shafts. Even shafts already scored can be satisfactorily sealed.

Pressures at seal up to 100 psi at 75°C or 75 psi at 100°C.

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UNITED STATES GASKET COMPANY
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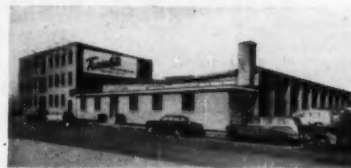
USG

**FABRICATORS OF
FLUOROCARBONS & OTHER PLASTICS**

Representatives in principal cities throughout the world



FIRMS . . .



Tensolite Insulated Wire Co., Inc., Tarrytown, N. Y., has completed new plant additions that have doubled production capacity.

Case Institute of Technology will construct a four-story addition to its new chemical engineering building in Cleveland.

Nat'l Lead Co. has acquired the capital stock of the So. Screw Co., Statesville, Ohio.

Standard Oil Co. plans to add a 6,000 b/d ultraforming unit to new facilities at its Mandan, N. D., refinery.

Pittsburgh Plate Glass Co. plans to purchase the Barreled Sunlight Paint Co., Providence, R. I.

Sandvik Steel, Inc., supplier of specialty strip steels, is now building a new 85,000 sq. ft. plant in Fair Lawn, N. J.

The Babcock & Wilcox Co. is now operating a new quality control laboratory at the Tubular Products Div. plant in Beaver Falls, Pa.

E. I. duPont de Nemours & Co. Inc. plans to build a \$1 million Freon research laboratory near Wilmington.

General Controls Co., Glendale, Calif., has offered to purchase the assets of the Controls & Instrument Div. of the Perflex Corp.

Coos Bay Pulp Corp. will soon construct a \$1 million addition to its Anacortes, Wash., plant.

American Smelting & Refining Co. has opened Wyoming's first uranium ore buying station.

Nopco Chemical Co. has acquired warehouse facilities in Portland, Ore.

Gewerkschaft Erdoel-Raffinerie, Lin-gen, Germany, has awarded the

PUNCHES and DIES

IMMEDIATE DELIVERY
ON MOST STANDARDS

4 to 5 WEEKS DELIVERY
ON SPECIALS

ARTHUR COLTON COMPANY

Div. Snyder Tool & Engineering Company
3465 E. LAFAYETTE • DETROIT 7, MICHIGAN

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PRECISION

FILTERS?

The smooth, tough surface of electro-deposited **LEKTROMESH** . .

the great uniformity of hole size — the wide range of commercial "mesh" sizes from 25 to 400 per inch—plus the fact that it can be stamped, cut, and even scraped without distortion of its mesh, all make

LEKTROMESH

ideal for precision filtration when you need pure nickel, pure copper, or a combination of copper-nickel.

Write Department 15



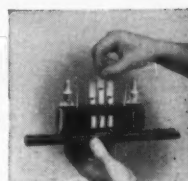
TAYLOR COMPARATORS



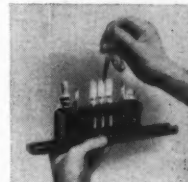
"never
knew
pH,
CHLORINE,
PHOSPHATE

TESTS could be
so easy!"

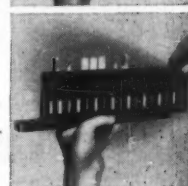
Just fill 3 test tubes
with the sample to
be tested and place
them in the base...



add reagent to
middle tube only...



place color stand-
ard slide on base.
Move the slide
across until the
colors match and...



*There's the
Value!*

You can make pH, chlorine, phosphate or nitrate determinations with these 3 easy steps with Taylor Comparators. Complete water analysis, including fluorides, is only a little more detailed when you use a Taylor Water Analyzer. Taylor sets are lightweight, durable, portable. Many different tests can be made on a single base. Best of all . . .

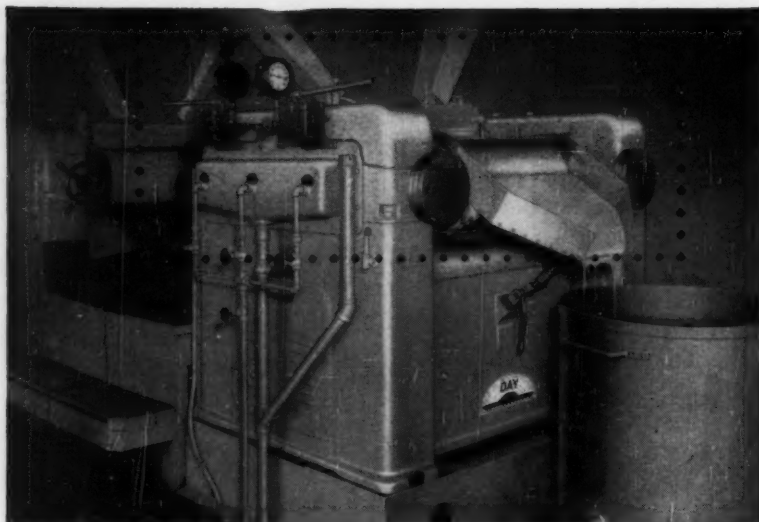
COLOR STANDARDS ARE GUARANTEED

Taylor liquid color standards carry an unlimited guarantee against fading, thus there's no chance of mechanical inaccuracy. Since a complete set of standards for any one determination is enclosed in a sturdy plastic slide, there's no need to handle fragile single standards.

SEE YOUR DEALER for Taylor sets or write direct for **FREE HANDBOOK**, "Modern pH & Chlorine Control." Gives theory and application of pH control, illustrates and describes full Taylor line.



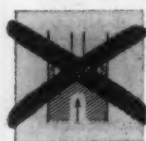
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414 RODGERS FORGE RD. • BALTIMORE, MD



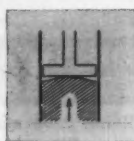
guessing...
games...
are...
over...



DAY HYDRA-SET... a unique hydraulic roll-setting device that takes all the guesswork out of roll settings... developed by DAY engineering, field tested with spectacular results. One simple setting gives unvarying accuracy to your roll mill work, resulting in absolute uniformity of every batch of paint. With the DAY Hydra-Set your roll position is absolutely constant once you make the setting.



OLD WAY



HYDRA-SET

HERE'S WHY: The Day Hydra-Set incorporates a sealed hydraulic cylinder. A synthetic rubber diaphragm prevents piston leakage, thus maintaining constant pressure at all times.

DAY Hydra-Set comes as optional equipment on new mills or as a field conversion kit. Write for Specification Sheet I-400 R.M.

FOUNDED 1887

in roller mills

DAY

means longer life span

THE J. H. DAY COMPANY

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Mexico: T. de la Pena e Hijos, S.A., Nazas 45-A, Mexico 5—D.F.

FIRMS . . .

Lummus Co. a contract for the construction of a houdriforming unit.

E. I. duPont de Nemours & Co., Inc., has opened its new laboratory for the development of design techniques in the field of plastics. The \$3 million installation is located in Wilmington.

Allied Chemical & Dye Corp. is producing a higher concentration formaldehyde at its new So. Point, Ohio, plant facilities.

General Latex & Chemical Corp., Cambridge, Mass., has built a new plant in Ashland, Ohio, at a cost of \$300,000.

Nat'l Starch Products Inc. has begun a \$3½ million expansion program at its Plainfield, Chicago and San Francisco facilities.

Crown Zellerbach Canada Ltd. will construct a \$4 million Lulu Island paper converting and box mfg. plant, near Vancouver, B. C.

Bristol-Myers has offered to purchase the class A and class B common stock of the Emerson Drug Co., Baltimore.

Marquette Cement Mfg. Co. will soon build a 1.5 million bbl. cement plant in the Chicago area.

Olin Mathieson Chemical Corp. will establish a facility in the Pittsburgh area for the handling of anti-freeze products.

Marietta Concrete Corp. has completed a \$100,000 building addition to its branch plant in Baltimore.

J. M. Huber Corp. has put its new ink plant in Eldon, Tex., into operation.

Peace River Glass Co., Ltd., Edmonton, plans to construct a \$75,000 glass factory for the production of glass fiber.

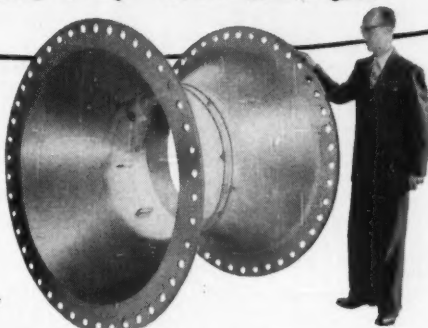
Illinois Zinc Co. will propose an amalgamation with Canadian Javelin Ltd. and Boon-Strachan Co., Ltd., both of Montreal.

Joseph T. Ryerson & Son, Inc., has acquired the plant and stocks of

it's REVERSIBLE

The *Gentile*^{*}
FLOW TUBE
measures flow
in either
direction

* GEN-TIL-LY



REVERSIBLE... The Flow Tube is symmetrical, with upstream and downstream ports identical. When the flow is reversed, the differential is reversed. Permits metering reverse flow at lowest possible equipment cost.

LOW INSTALLED COST... Average length is only $1\frac{1}{2}$ times the pipe diameter, and straight runs entering and following are not required unless installed near throttling valves or regulators.

ACCURACY... Produces differential from points of equal cross-sectional area... furnished with head capacity curves, and guaranteed for exceptional accuracy when used with any standard indicating, recording or integrating meter.

LOWEST HEAD LOSS... The Flow Tube can be designed to produce a measurable differential with the lowest permanent pressure loss of any type head meter.

Write for Bulletin FT-101, or for specific recommendations.

FOSTER ENGINEERING COMPANY

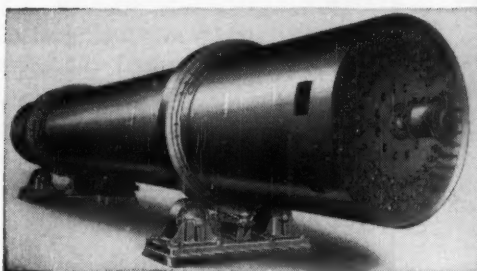
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UNION, N. J.

AUTOMATIC VALVES • SAFETY VALVES • FLOW TUBES



8'0" Diameter x 60'0" Long
"DAVENPORT" ROTARY
Steam Tube DRYER



DAVENPORT

PRESSING — DRYING
and COOLING Equipment

Continuous DeWatering
Presses

ROTARY DRYERS
Steam Tube, Hot Air
and Direct Fire

ROTARY COOLERS
Water and Air

**INSTALLED AT THE GLIDDEN Co.,
CHEMURGY DIVISION**

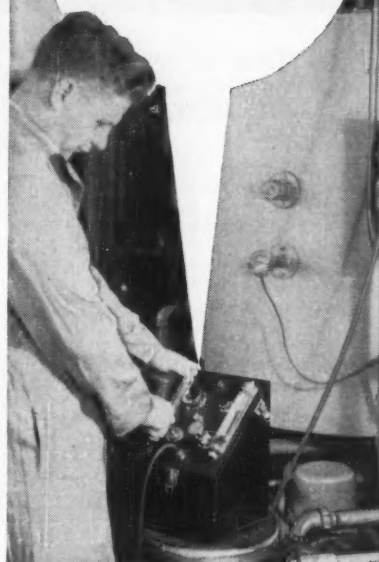
This unit has been installed recently to supplement Glidden's drying capacity on Soya Bean Flakes.

Let our engineers assist you on any of your de-watering — drying — or cooling problems.

Send for our complete catalog A or for quick reference, consult your *Chemical Engineering Catalog*, 1954 or 1955.

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DAVENPORT, IOWA
U.S.A. FOUNDRY COMPANY

read
dew points
INSTANTLY
...ACCURATELY

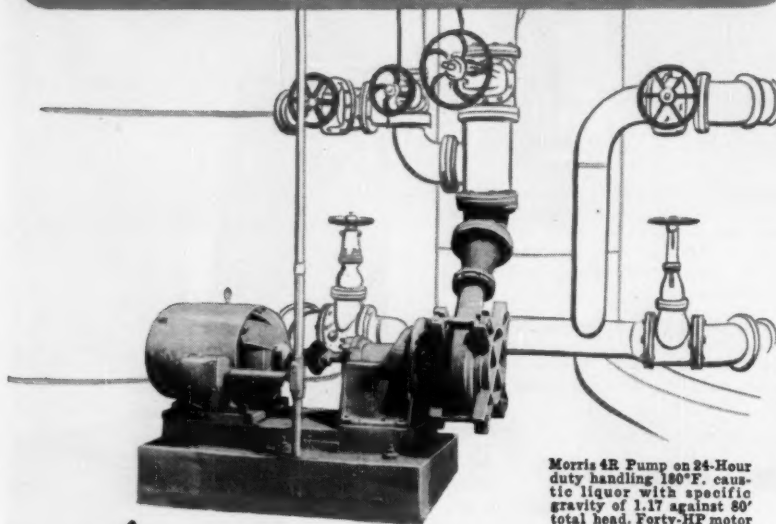


The Alnor Dewpointer takes the guesswork out of dew point readings... makes it easy, even for non-technical personnel, to achieve consistent accuracy. That's because fog is suspended in an enclosed chamber, under controlled conditions which can be reproduced time after time... anywhere. This means faster readings, too, with no time lost calculating variables. And the Alnor Dewpointer is completely self-contained, requires no external coolant or auxiliary apparatus. It operates on either a.c. or the enclosed battery. Available in three ranges... for dew points between -20°F. and room temperature, from -80°F. to -0°F. and from -80°F. to room temperature. For more information, send for your copy of the Alnor Dewpointer Bulletin. Illinois Testing Laboratories, Inc., Room 559, 420 North La Salle Street, Chicago 10, Illinois.



PRECISION INSTRUMENTS
FOR EVERY INDUSTRY

For Continuous 24-Hour Pumping of solid or-chemical mixtures



Morris 4R Pump on 24-Hour duty handling 180°F. caustic liquor with specific gravity of 1.17 against 80' total head. Forty-HP motor runs at 1180 RPM.

✓ Morris Type R Slurry Pumps

Ordinary harsh abrasives wear out your pump. Corrosive action of acids eats away its utility. Time-consuming maintenance and repairs cut down your production. Here's why the Morris Type R helps avoid these problems . . .

- 1.—**Simple design.** No internal studs and bolts—no troublesome internal joints and fits.
- 2.—**Easily dismantled.** Impeller and shaft sleeve reached by simply removing 4 external bolts.
- 3.—**Abrasive resistant.** Casing furnished in large variety of wear-resistant materials, including glass or porcelain.
- 4.—**Large hydraulic passages.** Permit low velocities to minimize wear and frequency of renewals.
- 5.—**Drive-side suction.** Stuffing box troubles practically eliminated under conditions of high suction pressure, high vacuum and high suction lift.

Let our engineers help you select the right pump for your job. Or write for Bulletin No. 181.

MORRIS MACHINE WORKS

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MORRIS

Centrifugal Pumps

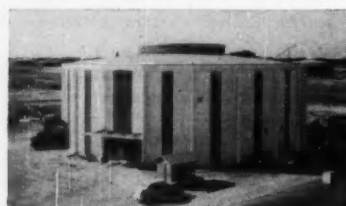
FIRMS . . .

the Arthur C. Harvey Co., Boston, steel and aluminum agent.

SKF Industries, Inc., has acquired the controlling interest in Tyson Bearing Corp., manufacturer of a line of tapered roller bearings.

Pan American Refining Corp. has put its new multi-million dollar ultraforming unit on stream, in Texas City, Tex.

Cook Electric Co., Chicago, has opened a new district office in Baltimore.



Continental Oil Co. has converted an 80,000 barrel oil storage tank in Ponca City, Okla., into a research laboratory.

Great Western Sugar Co., Denver, has purchased three factories from the Great Lakes Sugar Co., Detroit.

Pennsylvania Salt Mfg. Co. will place its new anhydrous ammonia plant in Portland, Ore., on stream this Spring.

Stauffer Chemical Co., New York, has completed a modern insecticide and fungicide blending plant in Lubbock, Tex.

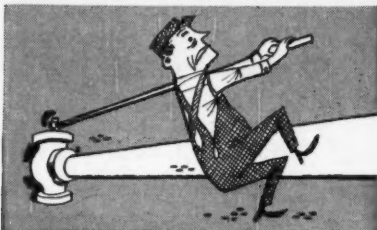
The Sherwin-Williams Co., San Leandro, Calif., will open its \$1 million can mfg. plant this Fall.

Olympic Metal Products Co., Inc., has announced the completion of a 100% expansion in its Alpha, N. J., plant facilities.

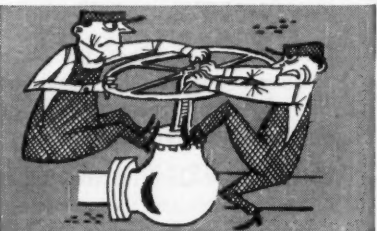
Petroleo Brasileiro, S. A., has awarded a contract for the erection of an asphalt plant in Cubatao, Brazil, to Southwestern Eng. Co.

West Virginia Pulp & Paper Co. plans to spend \$100 million for new plants and equipment during

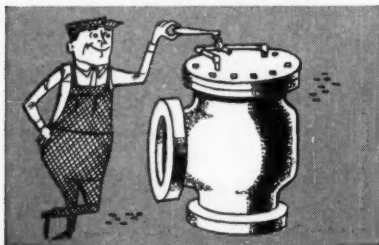
Do you have to
operate your **PLUG
VALVE** like this?



Or do you have to use
Two Men to operate
your **GATE VALVE**
like this?



then install the
**G-A
FLOWTROL
VALVE**
which can be operated
LIKE THIS



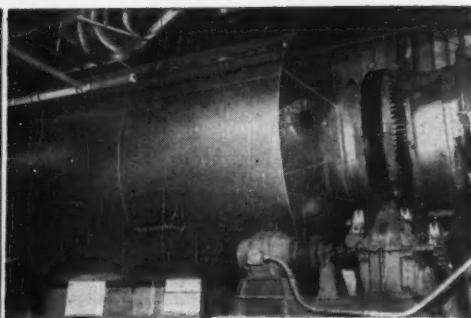
Standard-built for pressures
up to 300 psi
Built to order for higher pressures
Sizes **2" to 36"**
**WRITE FOR TECHNICAL FACTS
TODAY**

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ANDERSON**
Valve Specialty Company
1203 RIDGE AVE., PITTSBURGH 33, PA.
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VALVES FOR AUTOMATION

**Chemicals
are Dried
Completely,
Quickly,
Economically**

in
DehydrO-Mat*

* PAT. PENDING



BUILT IN A WIDE RANGE OF CAPACITIES, the DehydrO-Mat, though comparable in price, out-performs conventional dryers of similar size. Compact . . . easy to install in a minimum of space.

The DehydrO-Mat will not scorch or burn even the most sensitive chemicals. Air, not inclination, moves the material . . . quickly through the hot zone, slowly through the temperate zone. Since no boiler is necessary, the DehydrO-Mat can be in full operation from a cold start within ten minutes. DehydrO-Mats utilizing steam-heated air are also available.

Consult the Renneburg Engineers
on all your drying problems.
FREE literature and information on request.

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Baltimore 24,
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to an all-time low!**

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**ACID & CHEMICAL
RESISTANT
INDUSTRIAL APPAREL**

Du Pont
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DYNEL

- ★ ACID, CHEMICAL AND ABRASION RESISTANT!
- ★ U.S. NAVY SAYS: OUTWEARS COTTON 50 TO 1
- ★ LAUNDERS AND DRIES. QUICKLY — NO IRONING!

*Du Pont Orlon acrylic fiber

Save up to
93%

**NOW READY!
New, Free
CATALOG**

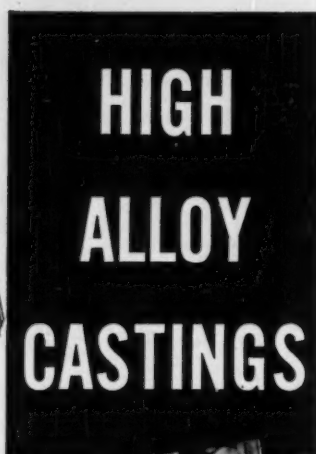
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FREE! Rush WORKLON's new, fully illustrated catalog of
ORLON, DYNEL WORK CLOTHES.

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Address.....
City..... State.....
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16

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useful
information
about

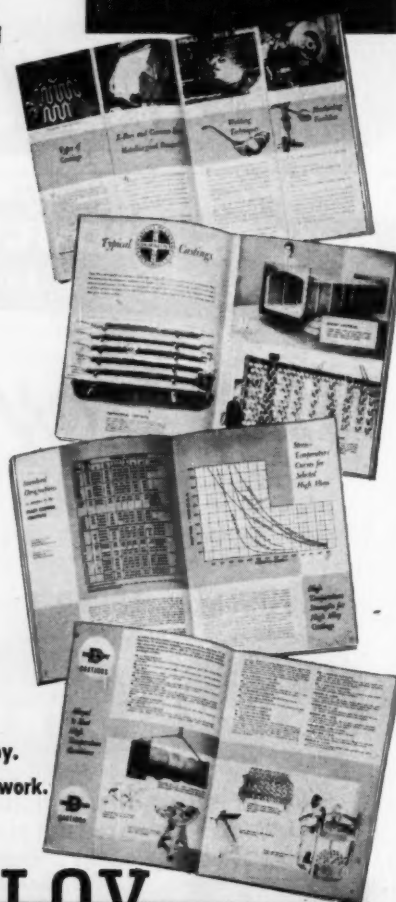


DURALOY **DURASPUN**

This is our New General Bulletin—3354G. It's full of information and data on the chrome-iron and chrome-nickel castings so necessary when corrosion, high temperatures and abrasion must be resisted. It will serve as a general selection guide for those specifying or using such castings.

The bulletin also reviews briefly our experience in both static and centrifugal castings, an experience going back to the pioneering days of 1922 and 1933 respectively. It also tells about our facilities for furnishing castings to any desired analysis, welding, X-ray and gamma ray testing, metallurgical and foundry control.

WRITE or CALL our nearest office for a copy.
We believe you will find it helpful in your work.



THE DURALOY COMPANY

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FIRMS . . .

ing the next 5 years, including \$30 million for a new Pennsylvania pulp mill.

Pan American Refining Corp. put the largest ultraforming unit in the world on stream in Texas City, Tex. Capacity of unit—21,000 b/d.

Jefferson Lake Sulphur Co., New Orleans, may buy the Merichem Co., Houston, manufacturer of sodium sulfide.

Pfizer plans to construct a new pharmaceutical plant near Ottawa, Ont., with an initial investment of \$750,000.

Byrea Chemicals, Inc., has begun construction on its ammonium nitrate plant, adjacent to the ammonia plant in Brea, Calif.

E. I. duPont de Nemours & Co., Inc., has selected a plant site near Antioch, Calif., for the manufacture of tetraethyl lead and Freon.

Borden Co.'s Chemical Div. has acquired the American Monomer Corp. and the Monomer-Polymer, Inc.

Aluminum Co. of America will expand its smelting capacity in Ft. Comfort, Tex., by 65,000 tons annually.

U. S. Phosphoric has obtained a contract from the AEC and will soon construct a uranium recovery plant to operate in conjunction with its East Tampa, Fla., superphosphate plant.

Corn Products Refining Co. has purchased all stock of the Laurel Products Inc., Cleveland.

Linde Air Products Co. will soon increase its laboratory facilities at Tonawanda, N. Y.

The Stauffer Chemical Co., New York, has awarded a contract to the Luria Eng. Co., Bethlehem, Pa., for the expansion of its insecticide factory in Tampa, Fla.

Pacific Coast Borax Co. has opened a Kansas City, Mo., office.

Sprout-Waldron & Co., Inc., Muncy, Pa., has purchased the

... no other
filtering medium
compares with
ANTHRAFILT

Trade Mark Reg. U. S. Pat. Off.



**Modern, All-Purpose
ANTHRAFILT
Stands Alone as the
One Filtering Medium
that is BEST for All
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Years of efficient and economical use in every type of filter plant has made Anthrafil the standard of excellence in the filtering medium field.

ANTHRAFILT is made from selected Pennsylvania Anthracite, low in ash, high in anthraxlon, low in friability, correctly shaped and sized for best overall results in filtration.

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and economical
filtration

ANTHRAFILT provides greater capacity ... longer filter runs ... cleaner washings at lower cost ... removes entrained turbidity from industrial process solutions or wastes.

Write today for full details
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Fights CORROSION HARD

ALPHA 101 AND 103 — Rigid PVC Plastic Pipe

Recommended for
3 out of 4
Chemical Lines

Good at licking corrosive problems. Mighty good for its perfect resistance to hydrochloric ... sulphuric ... nitric acid and more than 186 commonly used chemical corrosives — at lower temperatures and pressures. When the right PVC Pipe handles your fluid lines you solve corrosion problems permanently! That's why ALPHA 101 Normal Impact Unplasticized Straight PVC

or
ALPHA 103 High Impact Unplasticized Modified PVC Pipe is increasingly used! 1/2" to 4" sizes; full line of fittings.

- LIGHT WEIGHT
- EXCELLENT AGING QUALITIES
- NON FLAMMABLE
- HIGH TENSILE STRENGTH

Send for Complete Product Data Today

**ALPHA
PLASTICS INC.**



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SPRAYING SYSTEMS CO.

SPRAY NOZZLES

performance-proved
for every operation

Take advantage of the wide choice of spray nozzle types and capacities supplied by Spraying Systems to meet your needs exactly. Actually tens of thousands of precision, standard spray nozzles to choose from. Every kind of spray pattern.

STRAINERS ... high efficiency line strainers in all standard capacities.

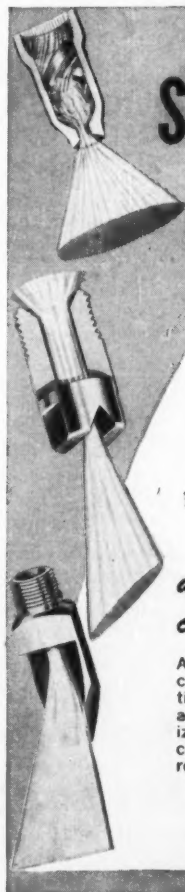
write for
catalog 24

A complete 48 page catalog with specifications on all standard and pneumatic atomizing nozzles. The most complete spray nozzle reference manual ever printed.



SPRAYING SYSTEMS CO.

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Use DENVER SAMPLERS

—for correct process control

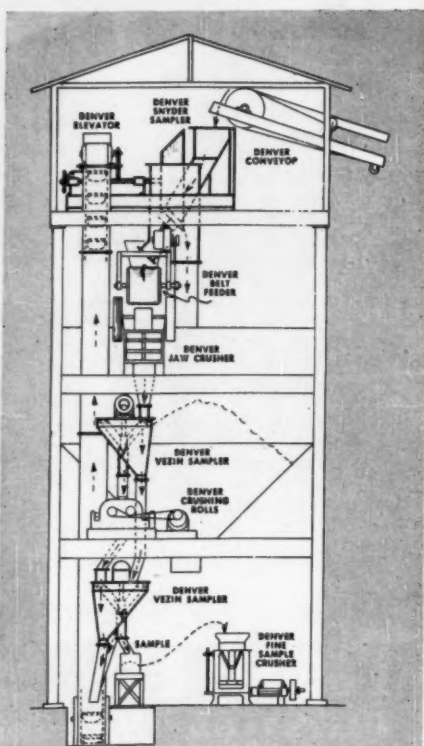


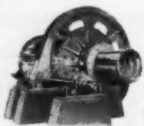



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Automatic process control means greater profits. Hand sampling, wherein a workman must stop what he is doing, take sample, then return to his work is only as reliable as the human elements involved.

May we please have the opportunity to work with you on your sampling requirements? Consultation is without obligation. Please write today.

A few examples of
DENVER PROCESS EQUIPMENT are:



DENVER Steel-Head BALL MILL		SIZES 3' x 2' to 6' x 12'	A Denver Steel-Head Ball Mill will suit your particular need. Five types of discharge trunnions. All-steel construction. Low initial cost due to quantity production. Quick delivery. Laboratory and pilot plant mills also available. Please write for Bulletin No. B2-B13.
DENVER Spiral Rake THICKENER		3' x 3' to 80' x 12'	Enclosed, running-in-oil head motion. Patented spiral rakes move settled solids to center discharge with continuous motion, rapid removal of solids tends to eliminate overload. Wood, Steel or Rubber-lined Tanks available. Write for Bulletin No. T3-B5.
DENVER Batch and Continuous TESTING		Laboratory and Pilot	Use Denver Testing Laboratory facilities for complete batch or pilot tests—your engineers or ours. Ample test facilities for investigations on crushing, grinding, mixing, classification, separation, sampling, leaching, concentration, thickening, filtration and drying. Consultation is without obligation. Please write for Bulletin No. T4-B15.
DENVER Rubber Lined PUMPS		Up to 2400 G.P.M.	Denver (Soft Rubber Lined) Sand Pumps lower pumping costs 30% to 70% due to simple design, lighter weight and accuracy of rubber parts which increase efficiency 1½ to 3 times over other sand pumps. Have molded rubber impellers and casing liners for long life. Write for Bulletin No. P9-B9.

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FIRMS . . .

assets of the Richmond Mfg. Co., maker of grading equipment.

Portland Copper & Tank Works, Inc., Portland, Me., will expand production of its super alloy fabricators.

Farmington Funding Corp., investment firm, plans to complete purchase of an 85% interest in the Wisconsin Oil Refining Co., Inc.

Boonton Molding Co., a pioneer in the plastics industry, has set up a special products div.

Stauffer Chemical Co. has organized a new educational and technical service program for agricultural and fertilizers dealers.

Stein, Hall & Co., Inc., has purchased the plant and equipment of the Limestone Starch Co., in Maine.

E. I. duPont de Nemours & Co., Inc., has begun a construction project at its Edge Moor, Del., plant to increase output of titanium dioxide.

New Names

The Barry Corp., Watertown, Mass., has changed its corporate name to the Barry Controls, Inc., to more accurately describe its functions.

Toklan Royalty Corp. has changed its name to the Toklan Oil Corp. The firm is located in Tulsa, Okla.

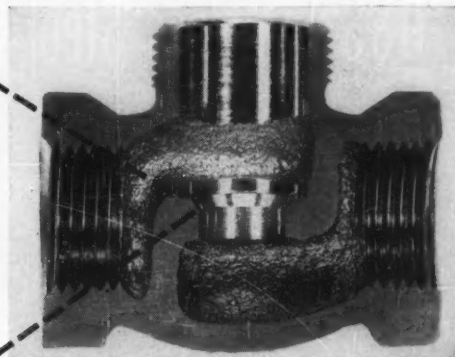
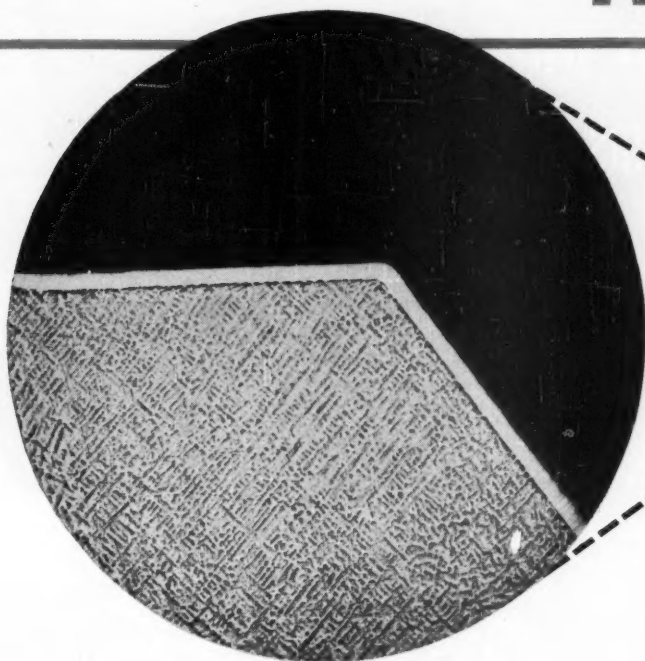
Chemical Industry Assn. has been selected as the new name for the Chemical Engineers of Greater New York.

Du Pont's Rubber Chemicals Div. has been renamed the Elastomers Div.

Carthage Hydrocol, Inc., subsidiary of the Stanolind Oil and Gas Co., has changed its name to the Hidalgo Chemical Co.

American District Steam Co., Inc., No. Tonawanda, N. Y., has changed its name to ADSCO Industries, Inc.

Plate Any Surface—with **ALCOPLATE***



This 1/2-in. valve body (actual size) was ALCOPLATED by immersion and sectioned to show thorough deposition of plate—even on interior valve seats. Photomicrograph (left) of valve seat illustrates ALCOPLATE's minute coverage of metal irregularities, evenness of plate deposit. Your ALCO salesman will be happy to show you one of these valve bodies, and he will supply you with ALCOPLATE samples for your own tests.

Complicated surfaces—impossible to electroplate or to clad—are corrosion-protected with ALCOPLATE

Almost any base metal—any shape—can be thoroughly plated with protective nickel by the ALCOPLATE process. ALCOPLATE, an electroless liquid-chemical plating method, *bonds* a uniform nickel coating to any surface. Coverage is complete and plate thickness, in normal assignments, is within 0.0003 in. of specification (0.003-in. thickness varies from 0.0027 to 0.0033 in.). Even on pieces impossible to electroplate there are no hard-to-reach areas, no costly overplating. And ALCOPLATE gives the plated material better corrosion resistance than electroplate. In fact, *it equals or betters the corrosion resistance of pure or wrought nickel.*

Here are some other advantages of ALCOPLATE:

- **Better composition than electroplate**—ALCOPLATE is harder, has almost *zero porosity* at minimum thickness. In some services where electroplate has failed because of porosity, ALCOPLATE is not affected.
- **Excellent plate adhesion**—ALCOPLATED steel specimens pulled to the yield point show no signs of flaking or spalling.
- **High abrasion resistance**—Hardness is 48 Rockwell C and can be increased to 66 Rockwell C through post-plate heat treatment.

ALCO invites your thorough investigation: Write ALCO, Box 1065, Schenectady, New York, for a copy of the new product bulletin on ALCOPLATE

ALCO

PRODUCTS

AMERICAN LOCOMOTIVE COMPANY

Consult your ALCO Sales and Engineering Representative at:

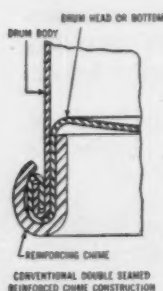
BEAUMONT, TEX.	PITTSBURGH, PA.
CHICAGO, ILL.	ST. LOUIS, MO.
CLEVELAND, OHIO	ST. PAUL, MINN.
HOUSTON, TEX.	SAN FRANCISCO, CALIF.
KANSAS CITY, MO.	TULSA, OKLA.
LOS ANGELES, CALIF.	WASHINGTON, D. C.
NEW YORK, N. Y.	

*ALCOPLATE—Trade-mark registration applied for. An application of "Kanigen," a mark identifying the chemical deposition of high-nickel, low-phosphorous alloy by General American Transportation Corporation and its licensees and the coating resulting therefrom—on license from the General American Transportation Corporation.

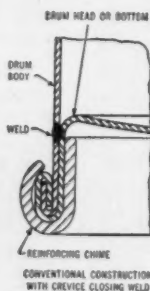
Here are important features that mean big savings with USS Stainless Steel Drums and Pails



USS Stainless Steel Drums are available with durable rubber rolling hoops (as illustrated) that give extra protection to both the drum and its contents from bumps and shocks, prolong the life of the drum, make handling much easier and quieter, and keep the drum from marking and marring floors.



Our special patented construction seals off the inner crevice or opening that usually results from the conventional double seam construction. This prevents the contents of the drum from entering the double seam and being trapped within the crevice, making it easier to do a thorough cleaning job.



United States Steel Products fabricates stainless, galvanized, tinned, painted and decorated drums and pails . . . furnished in a wide range of capacities and with a variety of fittings and openings to meet every industrial need. If you would like any additional information on USS Steel Drums or Pails, just write to us at New York.

1. USS Stainless Drums and Pails give you many times the length of life of drums and pails made of conventional carbon steel because of greater tensile strength, extra durability.
2. USS Stainless Steel Drums and Pails are returnable, can make many trips, reducing considerably the unit cost of your shipping containers.
3. USS Stainless Steel Drums and Pails give complete product protection during shipping or storage . . . stops worry about contamination from rust, scale, grease or dirt.
4. USS Stainless Steel Drums and Pails stay clean and new looking inside and out. This is important in promoting customer confidence. And products that require sanitary containers are dependably safe in USS Stainless Steel Drums and Pails.

These containers are available in both tight and removable head construction.

"It's Better to Ship in Steel"

UNITED STATES STEEL PRODUCTS DIVISION

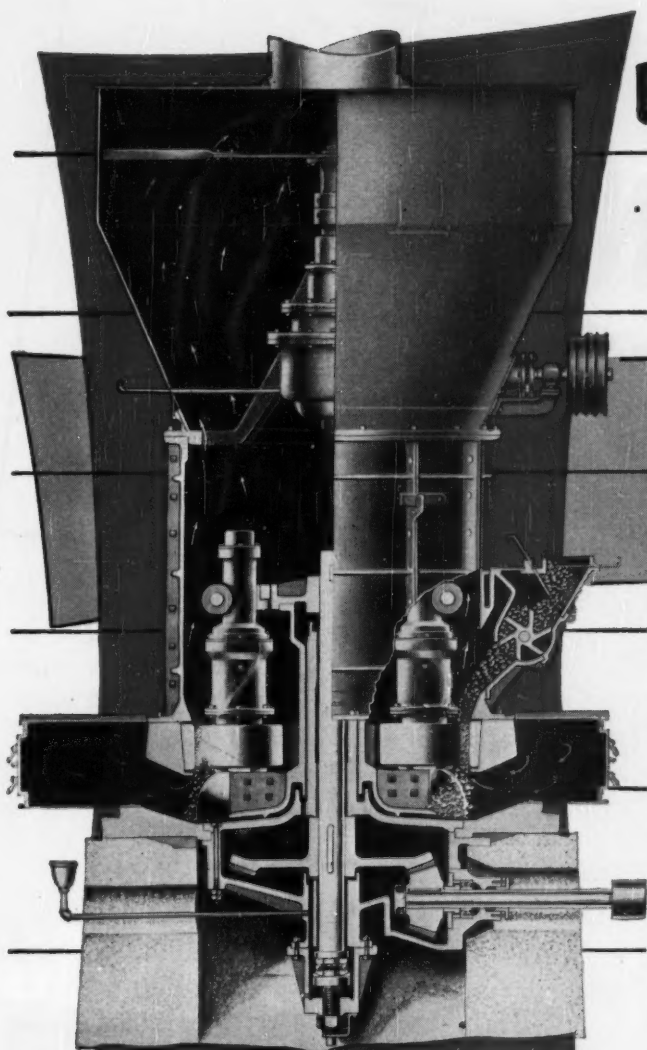
UNITED STATES STEEL CORPORATION
DEPT. 255, 30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.
Los Angeles and Alameda, Calif. • Port Arthur, Texas
Chicago, Ill. • New Orleans, La. • Sharon, Pa.
*Camden, New Jersey

*Expected Completion in April 1955

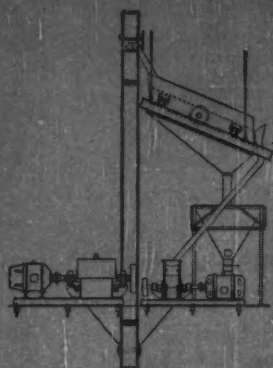
USS STEEL DRUMS



UNITED STATES STEEL



Cross section of Roller Mill showing how material is ground by rolls rotating against bull ring, then air swept to separator which extracts fines and returns coarse material to mill for regrinding.



WILLIAMS COMPLETE PLANTS

Williams builds all types of ready-to-install plants for crushing, grinding and air separation, including storage bins and electrical equipment. Consult the industry's most experienced engineers. Write!

Better Fine Grinding...

...How to improve accuracy, uniformity and output at reduced cost

WILLIAMS Roller Mills

Positive and continuous precision size control at exceptionally high production rates are only two of the superior features of Williams Roller Mills. Instant adjustment for grinding from 20 mesh down to 400 mesh, even to micron sizes, has established the Williams as one of the most versatile of fine grinding mills. Finished products can be maintained at finenesses of 99.9% + passing 325 mesh.

The operation of a Williams Roller Mill is simple, yet performance remains unsurpassed. Positive, self-adjusting feeding and blending of raw materials into the mill is automatic where pulverizing is done by grinding rolls spinning centrifugally against a bull ring. A continual rising current of cool air sweeps upward carrying ground material to the classifier that separates all finished fines from the coarse tailings which are all returned for further grinding.

Rugged construction promises less down time, lower power costs, minimum maintenance. Automatic take-up for wear is continuous.

Find out how easy it is to improve product quality and reduce production costs. Get all the facts about Williams Roller Mills.

Write today for literature.

TESTING AND RESEARCH LABORATORIES are at your service to help you solve every size reduction problem. Write for information.

WILLIAMS PATENT CRUSHER & PULVERIZER CO.
2706 N. 9th St. St. Louis 6, Mo.

WILLIAMS

CRUSHERS GRINDERS SHREDDERS



Hammer Mills Helix-Seal Mills Air Separators Vibrating Screens Feeders Impactors

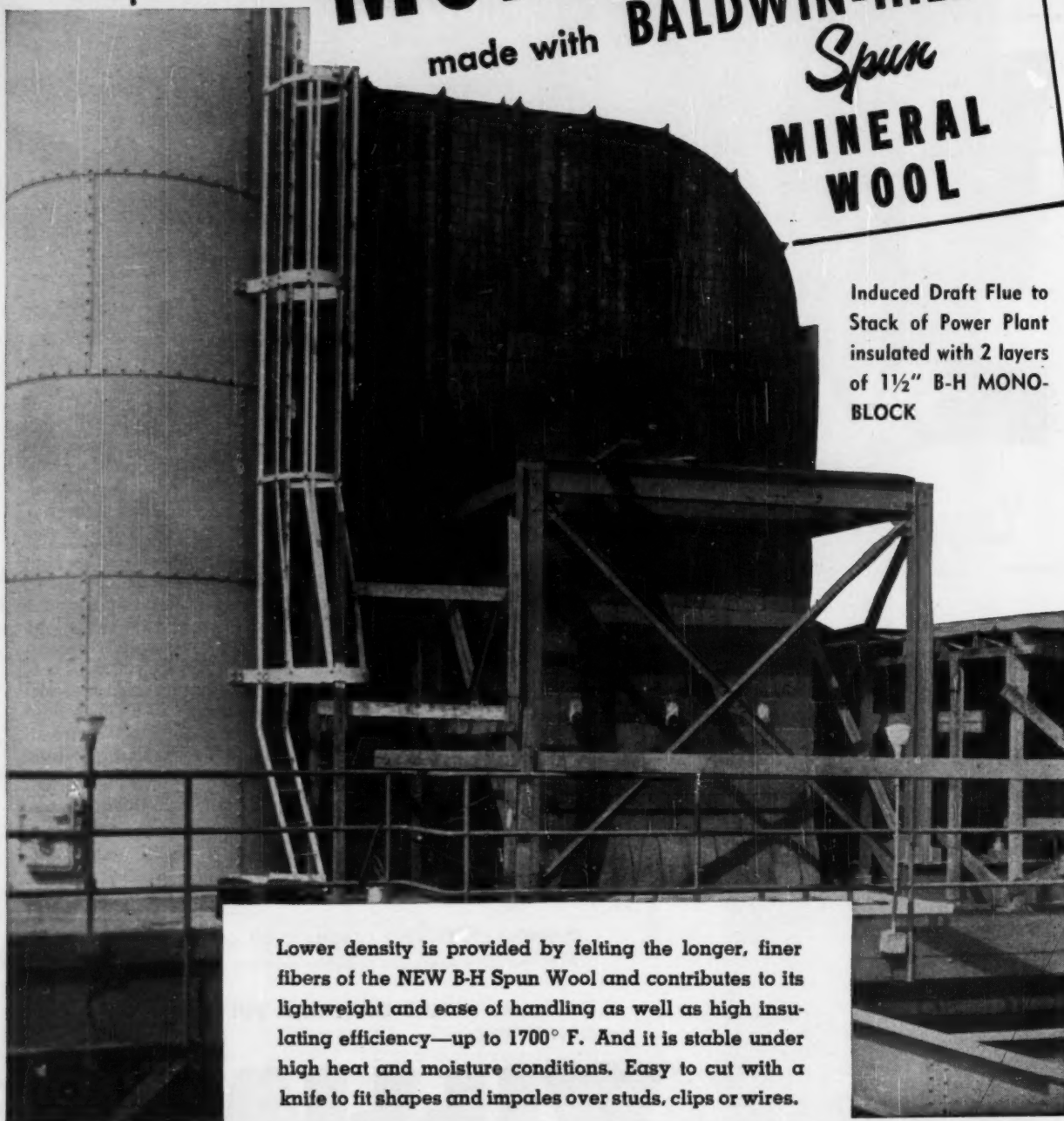
OLDEST AND LARGEST MANUFACTURER OF HAMMER MILLS IN THE WORLD



NEW LIGHTWEIGHT MONO-BLOCK

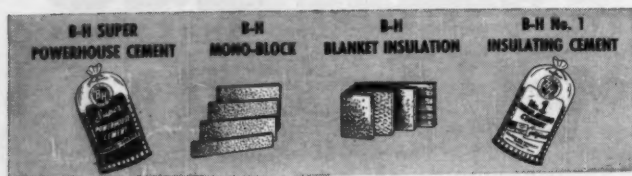
made with **BALDWIN-HILL**

Spun
**MINERAL
WOOL**



Induced Draft Flue to
Stack of Power Plant
insulated with 2 layers
of 1½" B-H MONO-
BLOCK

Lower density is provided by felting the longer, finer fibers of the NEW B-H Spun Wool and contributes to its lightweight and ease of handling as well as high insulating efficiency—up to 1700° F. And it is stable under high heat and moisture conditions. Easy to cut with a knife to fit shapes and impales over studs, clips or wires.



**BALDWIN-HILL
COMPANY**

1505 Breunig Ave., Trenton 2, N. J.

Kalamazoo, Mich. . . Huntington, Ind. . . Temple, Texas

When you buy welding elbows . . .



Why take less when you can get more?

. . . (and at the same price)

ADVANTAGES OF MIDWEST "LONG TANGENT" ELBOWS

- ★ They save pipe.
- ★ They often eliminate short nipples and their extra welds.
- ★ They save time and money in lining up and clamping pipe and fitting.
- ★ They make it easier to apply slip-on flanges.
- ★ They remove the circumferential weld from point of maximum stress and can be sleeved.
- ★ THEY COST NO MORE THAN OTHER ELBOWS.

As shown in the illustration above, Midwest "Long Tangent" welding Elbows have straight ends equal to $\frac{1}{4}$ of the nominal fitting diameter (a 12" elbow has tangents 3" long). For the reasons listed at the left, substantial savings are made on many piping systems by using Midwest "Long Tangent" Elbows. For more information about them, write for Catalog 54.

MIDWEST PIPING COMPANY, INC.

Main Office: 1450 South Second Street, St. Louis 4, Mo.

Plants: St. Louis, Passaic, Los Angeles and Boston

Sales Offices:

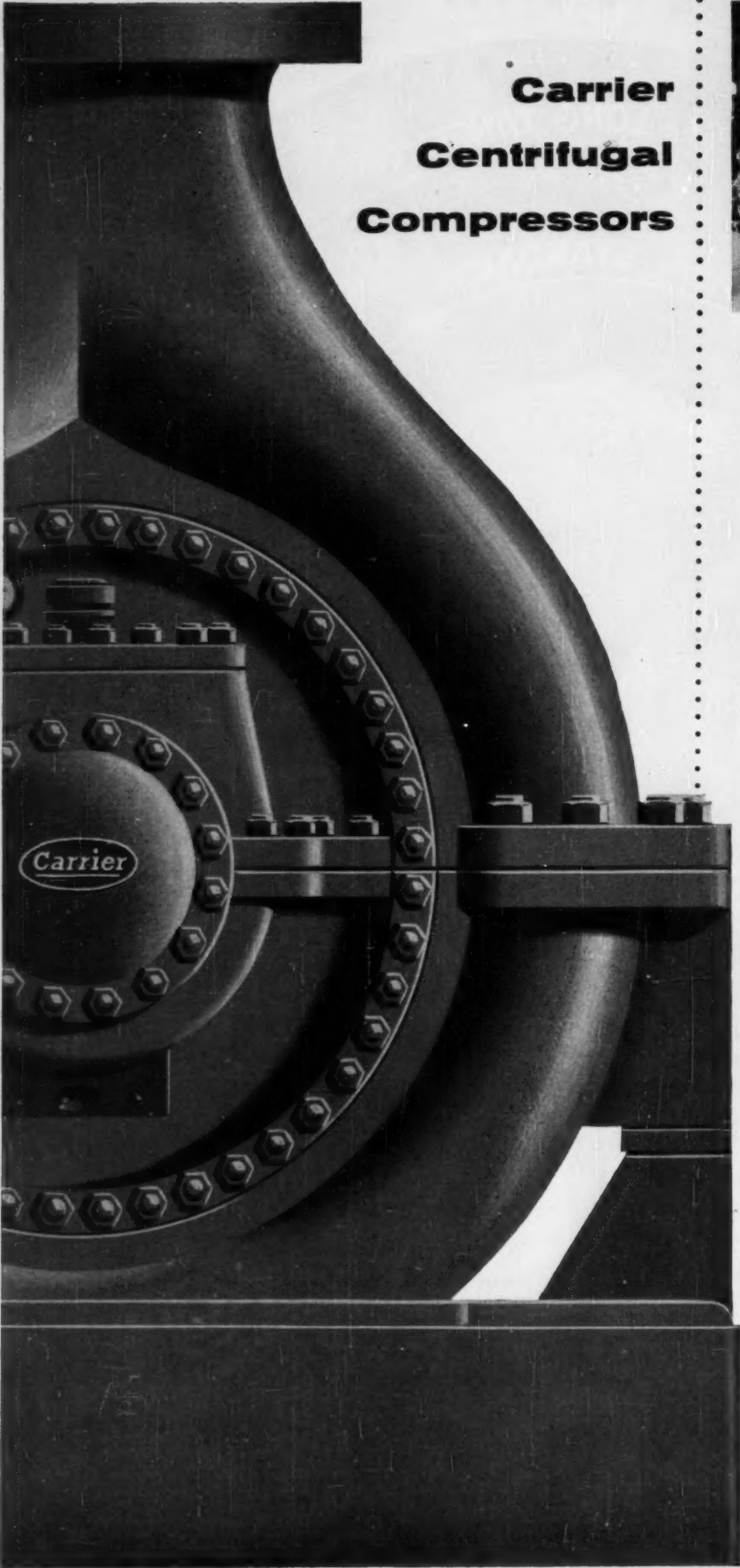
New York 7—50 Church St. • Chicago 3—79 West Monroe St.
Los Angeles 33—520 Anderson St. • Houston 2—1213 Capitol Ave.
Cleveland 14—616 St. Clair Ave. • Tulsa 3—224 Wright Bldg.
Boston 27—426 First St.

STOCKING DISTRIBUTORS IN PRINCIPAL CITIES

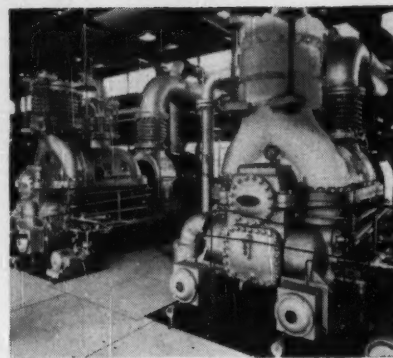
6722

MIDWEST

WELDING FITTINGS IMPROVE PIPING DESIGN AND REDUCE COSTS



Carrier Centrifugal Compressors



on the job at
**Olin Mathieson
Chemical
Corporation**

Two 3000-hp. Carrier Centrifugal Compressors are on the job at the Brandenburg, Kentucky, plant of the Olin Mathieson Chemical Corporation, compressing gas for liquefaction and pumping gas.

Other Carrier Centrifugals are in service at Olin Mathieson plants in Saltville, Va., and McIntosh, Ala.

Carrier makes a complete line of centrifugal and axial flow compressors for gas compression and refrigeration — up to 10,000 hp. in a single unit. There are hundreds of these dependable, efficient Carrier machines on the job at dozens of chemical plants and refineries across the country — Reichhold Chemicals Company, Cities Service Oil Company, Wyandotte Chemicals Corporation, The Texas Company. May we assist you?

If you'd like a copy of our booklet "Centrifugal Compressors for Industry," please call your nearest Carrier office. Or write direct to Carrier Corporation, Syracuse, New York.

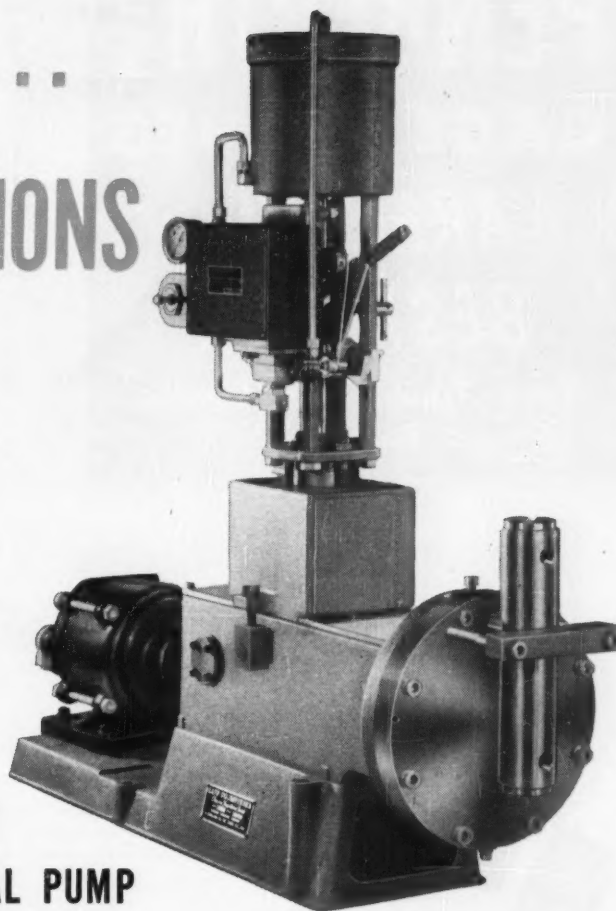


**centrifugal compressors
refrigerating equipment**

IT PUMPS ...
IT METERS ...
IT PROPORTIONS
IT FEEDS ...

WITHOUT LEAKAGE OR
CONTAMINATION

Lapp PULSAFEEDER CONTROLLED-VOLUME CHEMICAL PUMP



If your process requirements demand accurate handling of corrosive and non-corrosive liquids, here is the pump for the job. The Lapp Pulsafeeder is a piston-diaphragm pump . . . it has positive displacement with *no stuffing box*. The product being pumped is isolated from the drive mechanism by a hydraulically balanced diaphragm, thus preventing leakage or contamination of the product. Pumping speed is constant; variable flow results from variation in piston-stroke length . . . controlled manually by hand-wheel, or, in Auto-Pneumatic models, by instrument air pressure responding to any instrument-measurable processing variable.

WRITE FOR BULLETIN 440 with typical applications, flow charts, description and specification of models of various capacities and constructions. Inquiry Data Sheet included from which we can make specific engineering recommendation for your processing requirement. Write Lapp Insulator Co., Inc., Process Equipment Division, 350 Wilson Street, Le Roy, N. Y.

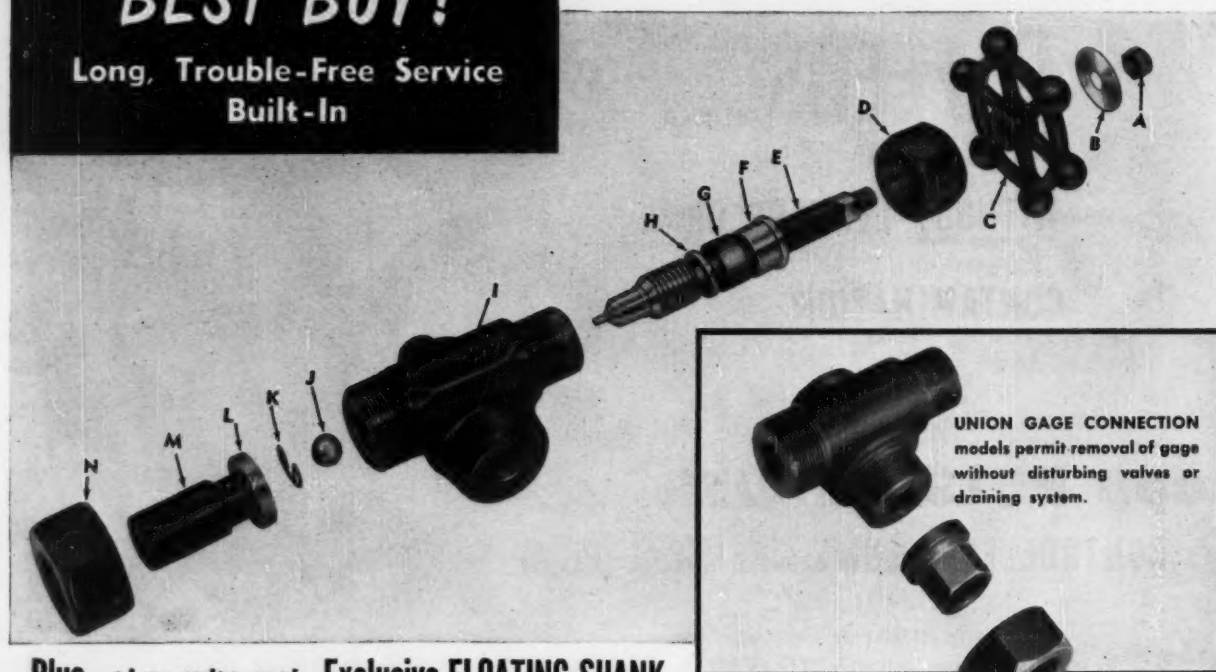
Lapp

HERE'S WHY PENBERTHY GAGE VALVES ARE YOUR BEST BUY!

Long, Trouble-Free Service
Built-In

Penberthy Type 300 Standard Liquid Level Gage Valve "Du-Lux" Black Enamel Finish

- A Steel Locknut
- B Identification Plate
- C Steel Wheel or Lever
- D Steel Stem Packing Nut
- E Stainless Steel Standard or Quick-Closing Stem
- F Stainless Steel Packing Gland
- G High Temperature Resisting Stem Packing
- H Stainless Steel Stem Packing Retainer
- I Forged Steel Body
- J Stainless Steel Ball
- K Stainless Steel Ball Retainer
- L Patented "Floating Shank"
- M Steel Tailpipe
- N Steel Coupling Nut



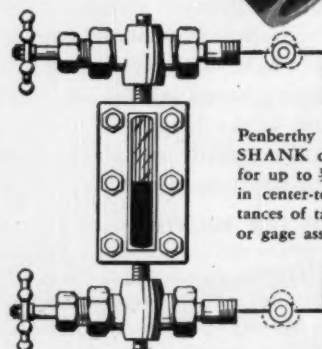
Plus...at no extra cost...Exclusive FLOATING SHANK

No other gage valve has all of the quality features of a Penberthy. Features that add up to top performance at lowest cost. You can see that for yourself in the "exploded" view of a Penberthy valve. In addition, the FLOATING SHANK is a time and labor saving feature that cuts installation and replacement costs by 50% or more. It also eliminates strain, caused by a forced installation, with its subsequent danger to the entire installation.

Try Penberthy Gage Valves on your next installation. See for yourself why they are your best buy. Obtain them through your local supplier or direct. WRITE for Catalog No. 35 showing the complete line...

PENBERTHY INJECTOR COMPANY

Division of the Buffalo-Eclipse Corporation
1242 Holden Avenue, Detroit 2, Michigan

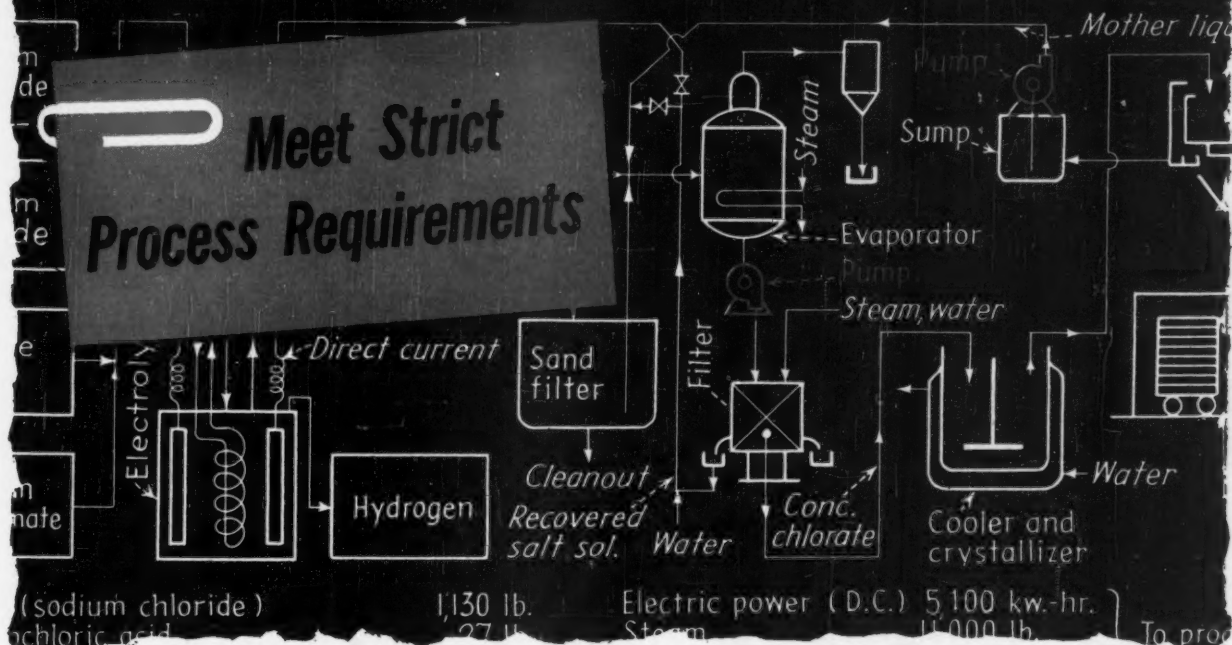


- GAGES
- EJECTORS
- EDUCTORS
- EXHAUSTERS
- SYPHONS
- ELECTRIC SUMP PUMPS
- CYCLING JET PUMPS
- INJECTORS

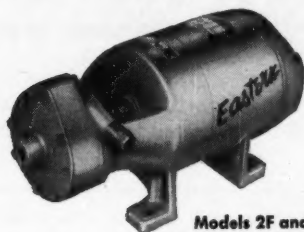
PENBERTHY

There's Certain Satisfaction in **PRODUCTS BY**

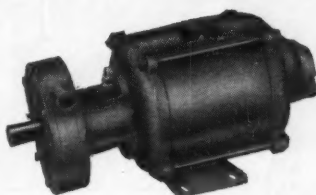
Meet Strict Process Requirements



... with Eastern Centrifugal Pumps



Models 2F and 2J
to 2 g.p.m., 25-42 p.s.i.



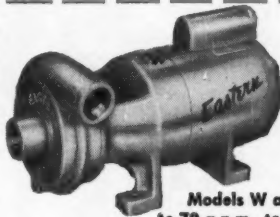
Model D-11
to 7.5 g.p.m., to 18 p.s.i.



Model F
to 17 g.p.m., to 17 p.s.i.



Models U-17 and U-34
to 38 g.p.m., to 21 p.s.i.



Models W and Z
to 70 g.p.m., to 11 p.s.i.

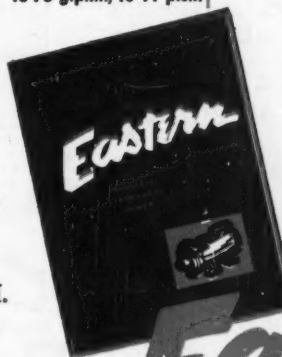


Models 3F and 3J
to 5 g.p.m., 29-65 p.s.i.

Recent redesign of these close-coupled Centrifugal Pumps has gained tremendous ruggedness and allowed for a wide selection of power requirements. In every detail of size, weight, space requirements, power, and costs, Eastern pumps fill the bill for strict process standards.

Six standard models range from 1/8th to 3/4 H.P., with capacities up to 70 G.P.M., pressures to 65 P.S.I. Eastern Centrifugal Pumps are available in Cast Iron, Bronze, Stainless Steel, Monel, and Hastelloy "C".

Eastern's engineering service offers many special models to meet your specific needs as to capacity and construction. Recommendations entail no obligation, and your inquiries are invited.



NEW EASTERN CATALOG
Eastern Centrifugal Pump
Catalog contains engineering
data, performance charts,
diagrams and helpful general
information. Request
Bulletin 110F.

Eastern

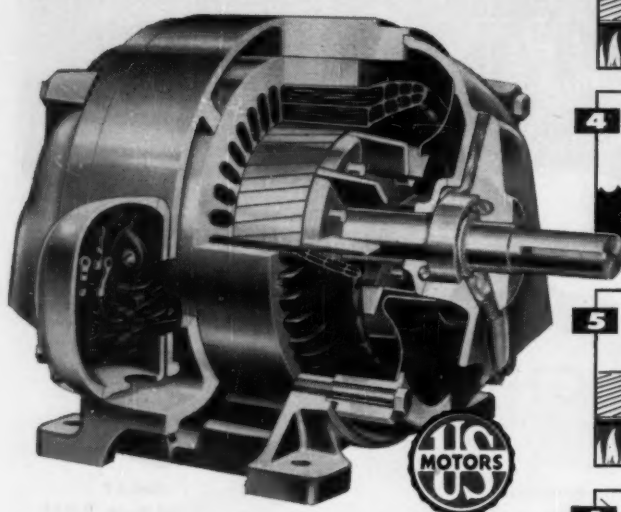


INDUSTRIES, INC.

100 SKIFF ST.
HAMDEN 14, CONN.

Asbestos-Protection

gives longer life to every **U.S. MOTOR**



Asbestos, greatest of heat-resisting elements and Nature's only incombustible fiber, insulates U. S. motor windings. Asbestos effectively resists burnouts because it will withstand high operative temperatures, *proved by 30 years of performance*. Materials commonly used for insulation include varnished cloth, oiled linen, paper, pressboard fiber, and insulating varnish, but *all of these will carbonize*, whereas asbestos remains invulnerable to heat attack; hence *longest life!*

Exclusive in all
U. S. MOTORS

U. S. ELECTRICAL MOTORS Inc.

P. O. Box 2058, Los Angeles 54, Calif. or Milford, Conn.

Send Booklet (s) showing advantages of asbestos-protection in

- ☐ Vardrives ☐ Unclosed Motors ☐ Totally-Enclosed Motors
☐ Synchro Motors

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COMPANY _____

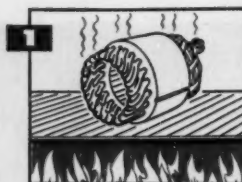
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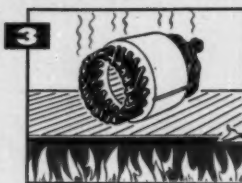
"What's cookin'?"

"The U.S. stator is pre-baked several hours to drive off every trace of moisture before insulating."



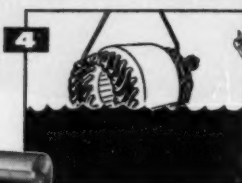
"What's the dunkin' for?"

"The stator is vibro-dipped in Asbestosite; wires electrically vibrated distribute insulation."



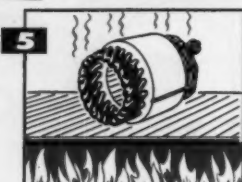
"Are you bakin' it again?"

"A second dip into the Asbestosite bath is made, to build up thickness of insulation."



"You already dipped it once."

"The second baking is applied for 12 hours to season Asbestosite and position wires."



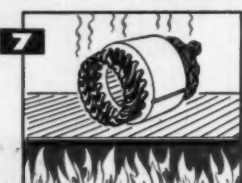
"Nothing half-baked about this, is there?"

"Right! A third baking cures the second coating to further protect windings."



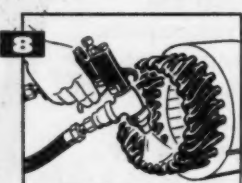
"Now what?"

"Windings are gun-sprayed with Asbestosite to form a smooth surface."



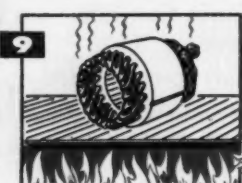
"Here we go again!"

"Yes, further baking for 3 hours hardens the coating to more completely protect windings."



"Here comes the gun again!"

"A final spray of asbestos compound is applied to provide very hard moisture-resistant finish."



"This is where I came in."

"A fifth and final bake of 12 hours insures impervious surface of coil insulation."



Here's Aluminum Chloride

in the **RIGHT SIZE** for your use

Most often, a particular process using aluminum chloride, anhydrous, works best with a selected particle size.

We have taken technical liberties in this picture (exposing aluminum chloride to the air) to show you the four sizes available from Hooker.

Extra work of screening isn't necessary when you specify Hooker aluminum chloride. The four sizes give you a choice that will meet just about every process requirement:

1. *Extra fine grind* is unscreened, with

90 to 95% passing 40 mesh.

2. *Fine grind* is unscreened, practically all passing 20 mesh.

3. *Coarse grind* is unscreened, 1 mesh and finer. It contains 25 to 35% finer than 20 mesh.

4. *Coarse screened* is the same as coarse grind (No. 3), but is screened to remove 20 mesh and finer.

Before re-ordering your requirements, get the facts on Hooker aluminum chloride. For technical data,

just phone the nearest Hooker office listed below, or mail the coupon today.

Need other chlorides? This is only one of several metal chlorides available from Hooker. Chlorinated organics and inorganics are specialties with us; we've been making them for more than 30 years. If you need a special chlorine-containing compound in quantity, we may be able to produce it for you economically. To find out quickly, just phone the nearest Hooker office or write us today.

FOR FAST SERVICE, PHONE:

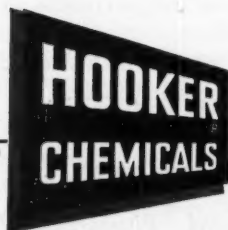
CHICAGO CEntral 6-1311
LOS ANGELES NEvada 6-3826
NEW YORK MUrray Hill 2-2500
NIAGARA FALLS 6655
TACOMA BRoadway 1215

HOOKER ELECTROCHEMICAL COMPANY, 5 Forty-seventh St., Niagara Falls, N. Y.

Please send:

- ☐ Data sheet on Hooker aluminum chloride, anhydrous
☐ Bulletin 100 describing Hooker products and services

Name..... Title.....
Company..... Address.....
City..... Zone..... State.....

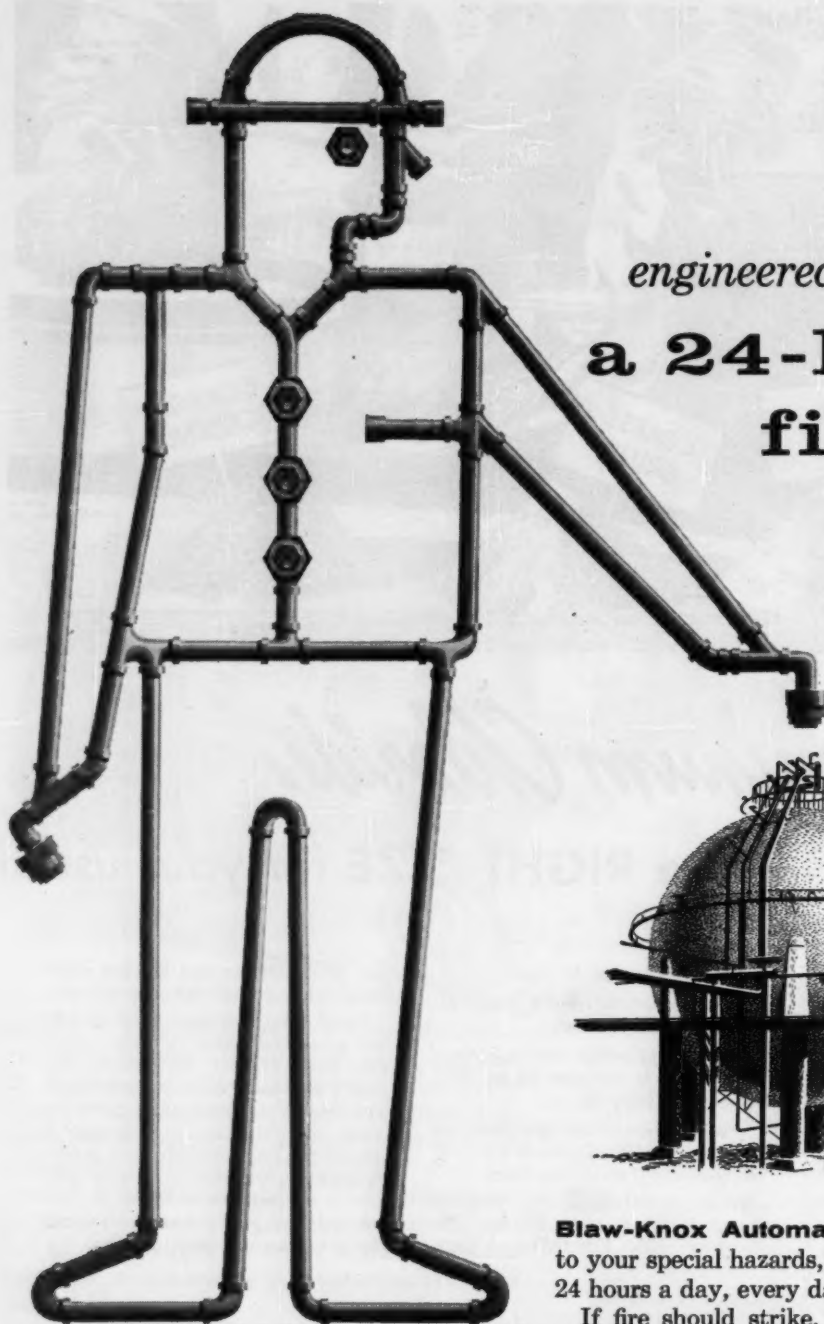


1905—Half a Century of Chemicals

From the Salt of the Earth—1955

HOOKER ELECTROCHEMICAL COMPANY

NIAGARA FALLS • TACOMA • MONTAGUE, MICH. • NEW YORK • CHICAGO • LOS ANGELES



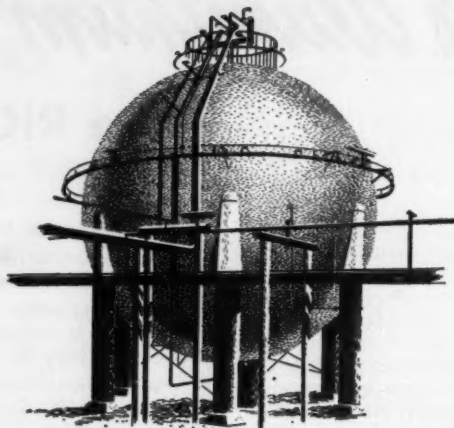
Blaw-Knox fire protection systems carry approvals of all insurance underwriters.

• Deluge Systems • Wet Pipe Systems • Dry Pipe Systems • Water Spray and Fog Systems • Rate-of-Rise Sprinkler Systems • Foam and Carbon Dioxide Extinguisher Systems

"Little Joey Sprinkler" always on the job



engineered by Blaw-Knox...
**a 24-hour
 fire guard**



Blaw-Knox Automatic Fog Systems, engineered to your special hazards, are fire guards that work for you 24 hours a day, every day in the year.

If fire should strike, your Blaw-Knox fire protection system will smother flames and dissipate heat quickly, thus checking possible loss of equipment and lives. It will also save you from such "hidden" dangers as loss of profits during downtime and loss of customers, possibly forever.

Blaw-Knox engineers have wide experience in water fog protection of chemical installations. We will gladly submit a layout and cost estimate of your requirements at no obligation. Why not call us today?

Send for a copy of our booklet, "Fire Can Destroy Your Business." You'll find it full of interesting facts.

BLAW-KNOX COMPANY

Automatic Sprinkler Department / Pittsburgh 33, Pa.



Make use of the Unique Advantages of TONNAGE OZONE in your Oxidations

You may have been limited in the past to traditional solutions of your oxidation problems... but now you are free to consider the value of this outstanding new approach—Welsbach Tonnage Ozone.

Ozone has always been regarded as a powerful oxidizing agent but there were problems—availability and dependability. Now those problems have been answered—with low-cost Tonnage Ozone, produced where it is used... by dependable Welsbach Ozonators.

Just consider these unique advantages—advantages which only Welsbach Ozone can offer!

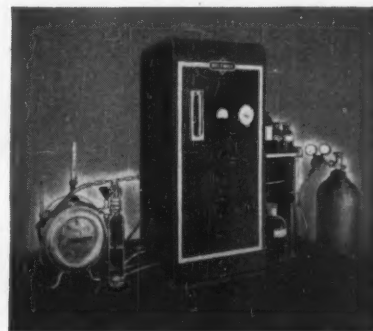
1. No procurement problems. No freight, storage or materials handling expense. Welsbach Ozone is generated where it is used.
2. Fully automatic for continuous processing—maintenance costs are negligible. And since the only raw materials needed are electricity and air or oxygen, operating costs are constant and predictable.
3. Inorganic reaction with ozone is quantitative and instantaneous. And, since only oxygen is added, no post-oxidative clean-up is needed.

4. Ozone cleavage of unsaturated organic compounds is very specific, resulting in higher yields of purer products at a lower cost.

5. Ozone can act as a catalyst in oxygen or air oxidations without requiring high temperatures and pressures.

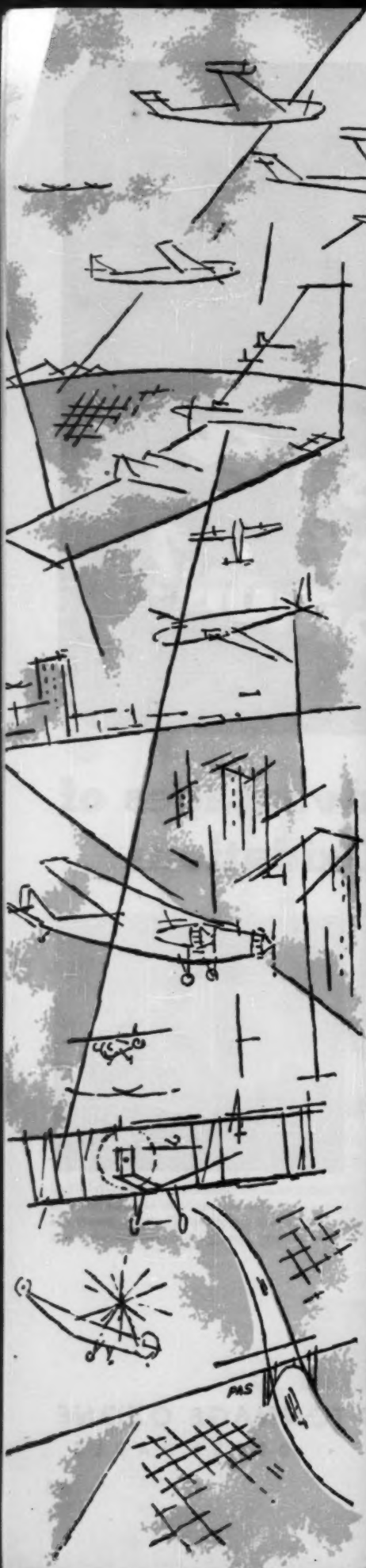
TRY OZONE IN YOUR LABORATORY

The Welsbach T-23 Laboratory Ozonator is designed specifically as a precision laboratory instrument capable of constant and reproducible operation, positively safe to use. It effects substantial savings in research time through earlier completion of research projects at a lower cost. Write today for descriptive folder on the Model T-23 and, if you wish, indicate the nature of your problem. The Welsbach Corporation, Ozone Processes Division, 1500 Walnut Street, Philadelphia 2, Pa.



Welsbach Model T-23 Laboratory Ozonator—Gives constant, reproducible operation with no ozone leaks, no electrical hazards and substantial savings in research time and money. You'll appreciate its professional refinements.

WELSBACH
 OZONE IS TONNAGE OZONE
 LOW COST • DEPENDABLE.



S IS FOR SUPERSONIC

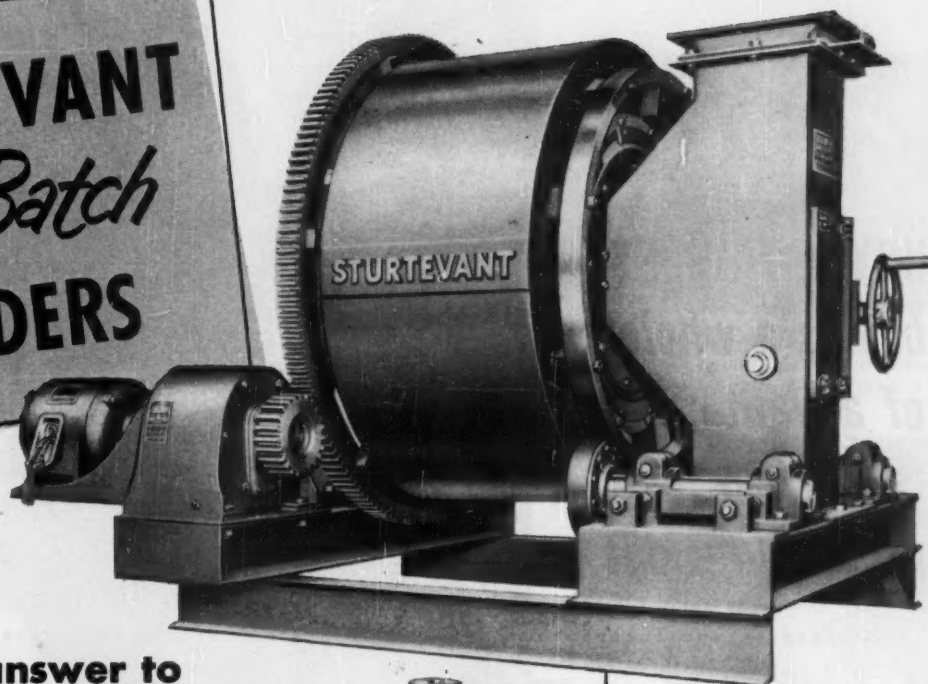
In every field of scientific and technological development sulphur, the element S, continues to be indispensable.

Having contributed importantly to the entire field of aviation from its earliest days, sulphur in this age of supersonic flight helps make possible the refining of increasingly higher octane gasolines and jet fuels and the production of heat-resistant metals, rubber, batteries, lubricating oil and other essentials!

As new uses of sulphur have developed, the methods of mining the mineral have also advanced. Freeport—a pioneer in the industry—devised ways to mine inaccessible marshland deposits, introduced the use of salt water in the Frasch process and developed other significant new techniques, many of them applicable to offshore mining. With new deposits harder to find and more costly to mine than before, these advances will help to assure a plentiful supply of sulphur to meet the ever-growing needs of our economy.

FREEPORT SULPHUR COMPANY

STURTEVANT *Dry Batch* BLENDERS



are the answer to **Fast, Economical Mixing**

Because of the unique design of its mixing chamber, and the 4-way mixing action which brings two or more substances together, the Sturtevant Dry-Batch Blender does a more rapid mixing job than other machines and, at the same time, it is complete and thorough in every particular. The substances may be of different weights and physical properties, and may be either dry, partly dry, or a mixture of both. Write for bulletin today.

Compare These Advantages

- Only one lever controls both receiving and discharging for simplicity of operation. Hand wheel operates rack and pinion slide at feed opening.
- 4-way mixing action speeds production . . . assures thorough blends.
- "Open-door" accessibility permits easy, fast, thorough cleaning.
- Single aperture drum for both intake and discharge.
- Unusually efficient scoops pick up materials to effect thorough mixing as drum revolves.
- 9 models . . . a size for every job . . . from 10 cu. ft. to 900 cu. ft. batches.

STURTEVANT MILL COMPANY

100 Clayton Street, Boston 22, Mass.

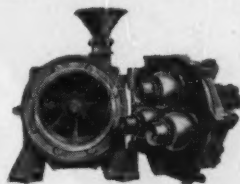
DESIGNERS & MANUFACTURERS OF
CRUSHERS • GRINDERS • SEPARATORS • CONVEYORS
MECHANICAL DENS AND EXCAVATORS • ELEVATORS • MIXERS



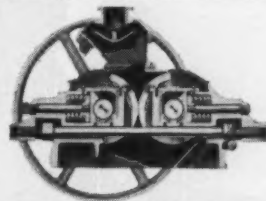
Micronizer® Grinding Machine. A fluid jet grinding machine, the Sturtevant Micronizer speeds reduction of materials to low micron sizes. These jet mills are especially applicable in fields where a particle size in microns is desired. Available for outright sale.



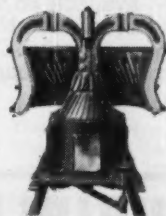
Air Separator — for separation of fines to 325 mesh and finer. Increases output from 25% to 300% . . . lowers power costs by 50%. Capacities $\frac{1}{4}$ to 50 tons per hour output.



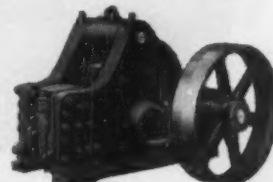
Ring-Roll Mills — for medium and fine reduction (10 to 200 mesh), hard or soft materials. Very durable, small power. Operated in closed circuit with Screen or Air Separator. Open door accessibility. Many sizes. No scrapers, plows, pushers, or shields.



Crushing Rolls — for granulation, coarse or fine, hard or soft materials. Automatic adjustments. Crushing shocks balanced. For dry or wet reduction. Sizes 8 x 5 to 38 x 20. The standard for abrasives.



Rotary Fine Crushers — for intermediate and fine reduction (down to $\frac{1}{4}$ "). Open door accessibility. Soft or moderately hard materials. Efficient granulators. Excellent preliminary Crushers preceding Pulverizers.



Jaw Crushers — for coarse, intermediate and fine reduction of hard or soft substances. Heavy or light duty. Cam and Roller action. Special crushers for Ferro-alloys. Several types, many sizes.

HOW STAINLESS STEEL *brings a whole set of advantages to critical processing jobs*



This 60-inch diameter nitric acid absorber tower typifies the application of stainless steel in the chemical processing industry. Made by the Vulcan Manufacturing Division of Cincinnati, Ohio, it is an excellent example of how several properties of a specific type of stainless steel team up to solve a tough chemical processing problem.

The stainless that Vulcan chose for the all-welded body is Crucible Rezistal® Type 347. Here are three big reasons why:

High tensile strength to minimize structural support.

Stability against formation of harmful carbides, both during welding and in high-temperature operation.

Remarkable corrosion-resistance to withstand lasting exposure to nitric acid. It is fully resistant to the acid in diluted form at any temperature, and to concentrated solutions at lower temperatures. It is satisfactorily resistant to concentrated solutions above the boiling point.

Your operations may not call for nitric acid absorber towers, but if they include any critical phase of chemical processing, check the many advantages offered by the 30 available types of Crucible stainless steel. You'll find details in "Making the Most of Stainless Steels in the Chemical Processing Industry," which is yours free on request. And, to find out what information is available on the many other Crucible special steels, ask for "Crucible Publication Catalog." Or consult your nearby Crucible representative. *Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 22, Pa.*

CRUCIBLE

first name in special purpose steels

Crucible Steel Company of America



This pipe would last **203** years on a diet of hot hydrochloric acid

Handling corrosive fluids may be forcing you to pay more than your share of industry's \$6,000,000,000 annual bill for the perpetual war against rust.

PYREX brand "Double-Tough" glass pipe can help you cut your corrosion losses.

This pipe carrying 5% hydrochloric acid at 212° F. loses only .0003 inch of its thickness in a year. At that rate it would take over 200 years to eat away 30% of the wall thickness. It would take over 600 years to eat completely through the pipe.

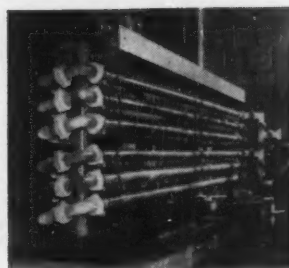
PYREX pipe not only resists eating away by hard-to-handle fluids. It's also easy to flush clean. Even sticky substances and organisms won't adhere to its hard, smooth

surface. Its transparency is often important, too. You can see what's going on inside—spot trouble in the making.

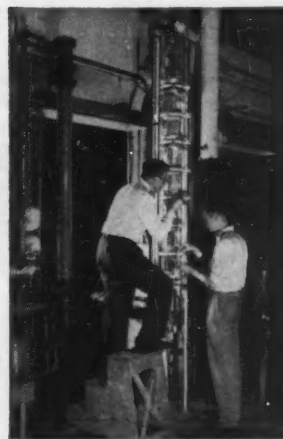
You don't have to worry about breakage. PYREX pipe is called "Double-Tough" because all fittings and flanged ends are tempered. This makes them 2½ to 3 times stronger than ordinary glass.

Easy to plumb

Your own men will find no difficult problems in installing and maintaining PYREX pipe. We maintain balanced stocks ranging in size from 1" to 6" I.D., including fittings to match the needs of most layout requirements and adapters for hooking PYREX lines in with other plant equipment.



SCALE DEPOSITS which impede heat flow do not form on the hard, smooth inside surface of the PYREX pipe in this heat exchanger.



You can see what's happening in PYREX brand glass fractionating columns. No corrosion. No contamination.

FREE BOOKLETS: Send the coupon or write for copies.

This illustrated "Installation Manual" describes the simple procedures involved in laying out and plumbing PYREX brand glass pipe.

This catalog describes the full line of PYREX pipe and fittings, including spacers, adjustable joints, traps, and adapter connections.



CORNING GLASS WORKS

15 CRYSTAL ST.
CORNING, N. Y.

Corning means research in Glass

CORNING GLASS WORKS, 15 Crystal St., Corning, N. Y.

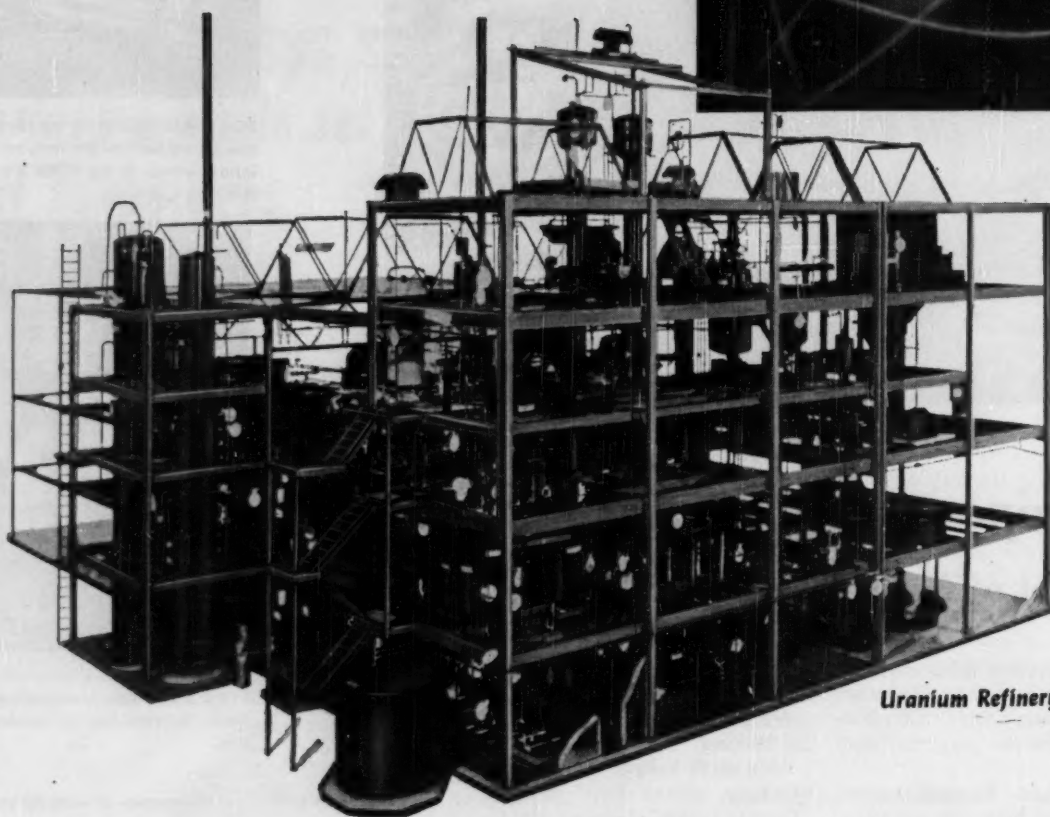
Please send me a copy of the PYREX pipe Installation Manual ☐
and a copy of the PYREX pipe Catalog ☐. I would also like more
information on heat exchangers ☐ and fractionating columns ☐.

Name.....Title.....

Company.....

Address.....

City.....Zone.....State.....



Uranium Refinery

MODEL for Tomorrow

The full scale commercial uranium refining plant—of which this is a model—is now under construction at Port Hope, Ontario, and will be completed in 1955, the first of its kind in Canada. With engineering and construction by Catalytic, it will make available to Eldorado Mining and Refining, Limited (a Crown Company)

the most advanced processes for uranium refining. This new example of our services in advancing uranium technology portrays Catalytic's position of leadership in the industry of tomorrow. We welcome your inquiries today—that Catalytic's on-time, on-budget services may contribute to your success of tomorrow.

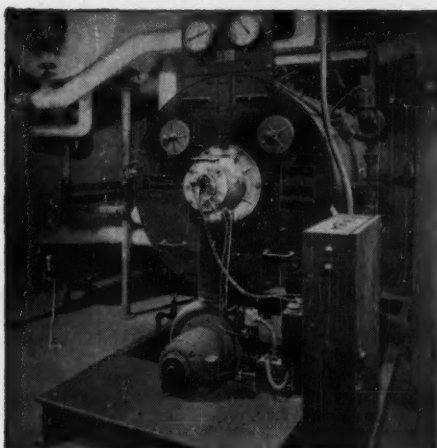
CATALYTIC ON-TIME...ON-BUDGET SERVICES

for the atomic energy, chemical, petrochemical and oil refining industries • Project Analysis • Process Design • Economic Studies • Engineering • Procurement • Construction • Plant Operation

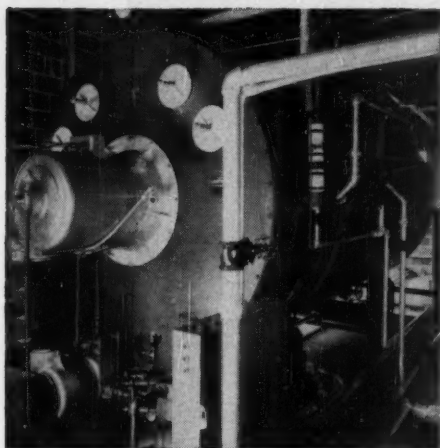


CATALYTIC
CONSTRUCTION COMPANY
1528 Walnut St., Philadelphia 2, Pa.

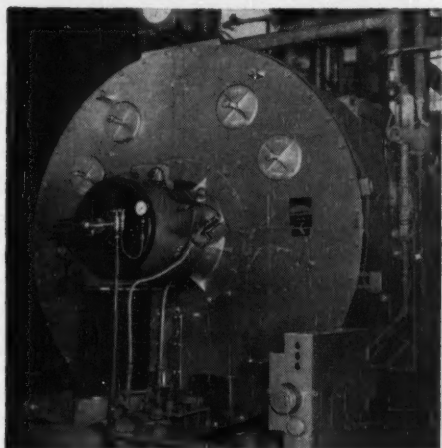
In Canada:
CATALYTIC CONSTRUCTION
OF CANADA, Limited
Sarnia, Ontario



Steam for heating new fertilizer plant is supplied by this 40 hp. *Powermaster*.



This 400 hp. *Powermaster* generates 100 psi. steam for processing industrial fish oil.



Process steam at 175 psi. for rubber products plant is supplied by this 500 hp. *Powermaster*.

CHECKED YOUR STEAM COSTS LATELY?

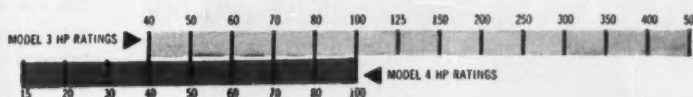
Powermaster[®]
saves in many ways!

In chemical plants, *Powermaster* Packaged Automatic Boilers are supplying steam for processing and heating with outstanding reliability and economy.

Powermaster savings start with simplified installation. No special foundation or costly stack is required. As delivered, space-saving *Powermasters* are completely factory-assembled, fully equipped and wired ready for operation as soon as water, fuel, electrical and flue gas connections are made.

Once installed, a *Powermaster* keeps on saving with these advantages: high fuel economy at all loads, fully automatic operating and safety controls, maintenance-saving accessibility, hospital-clean boiler room, smokeless combustion and long, trouble-free performance. *Powermasters* are entirely designed and built by Orr & Sembower, Inc., and are rigidly fire-tested before shipment.

To meet your specific operating requirements to *your* best advantage, *Powermaster* offers you two models covering a capacity range of 15 to 500 hp. as shown in the chart below. Oil, gas, or combination oil and gas firing is optional with both models in all sizes.



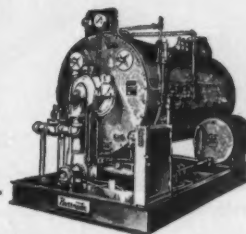
Pressure range: 15 to 250 psi., steam or hot water.

Check your steam costs, and then check the many cost-saving *Powermaster* advantages described and illustrated in our latest bulletins. Send for your copies NOW!

O-S
Powermaster[®] PACKAGED AUTOMATIC BOILERS
In sizes to 500 HP; pressures to 250 psi.

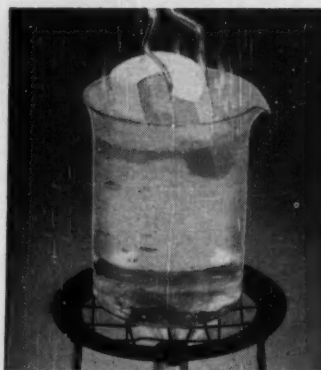
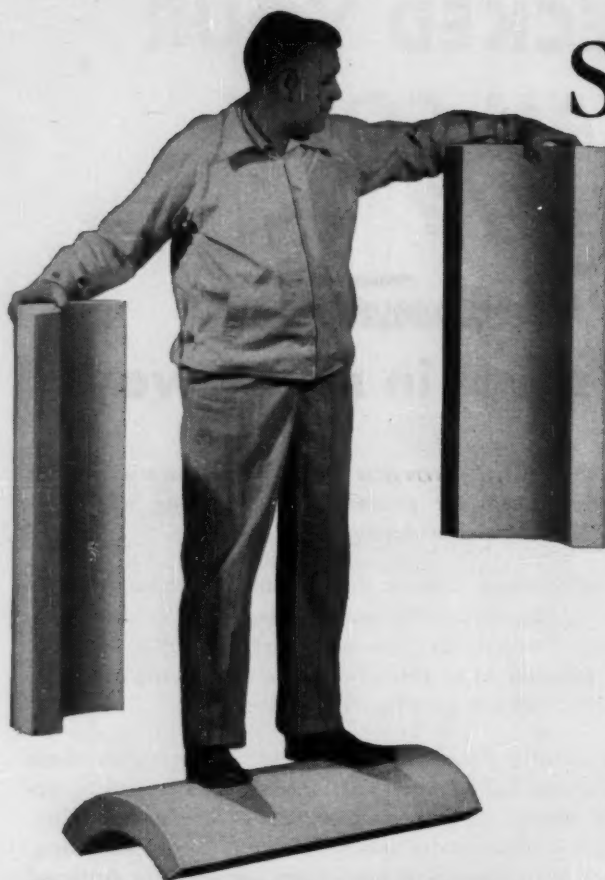
ORR & SEMBOWER, INC.

Morgantown Road, Reading, Penna.

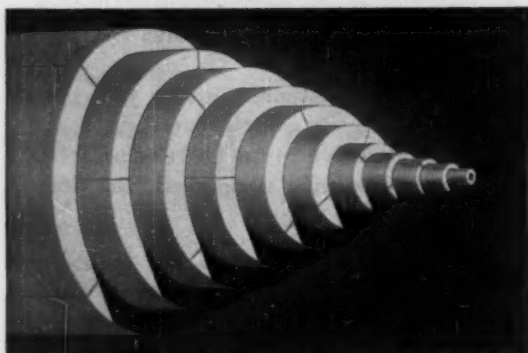


strength...

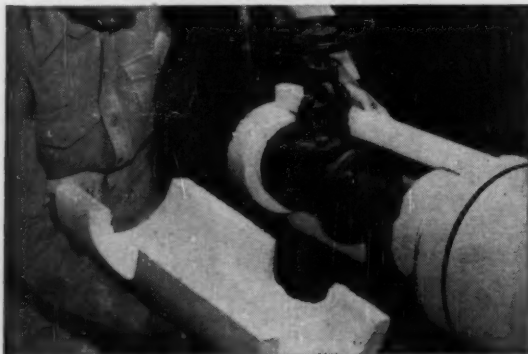
just one of
many reasons why
Kaylo is the king
of high temperature
insulations



Boiling water will not break Kaylo down. When soaked, it retains much of its strength. Dried, it returns to its original thermal efficiency.



Snug nesting where necessary. O. D.'s of Kaylo insulation correspond to O. D.'s of standard pipes from $\frac{1}{2}$ " to 24", assuring proper fit and nesting where necessary.



Easily cut with ordinary tools. Kaylo is light-weight and so workable that it can be removed and replaced for line inspections without waste.

Tested in thousands of industrial applications, Kaylo has flexural strength, compressive strength and resistance to abrasion far above normal requirements for heat insulation. It is a flawless performer at all temperatures up to 1200°F... through the hot water and low-pressure steam ranges and through the super-heated steam range. Its low coefficient of conductivity is the result of the smallness and number of its insulating air spaces, which present a material internal surface of approximately 100 acres per cubic foot.

Kaylo is made both as block and as molded pipe insulation with the widest range of sizes, forms and thicknesses of any high-temperature insulation. Now distributed by Owens-Corning Fiberglas Corporation, it provides, together with Fiberglas* Industrial Insulations, the most complete and versatile line of plant insulations available. For complete technical data, see our listings in Sweet's File, Chemical Engineering Catalog, or Refinery Catalog, or write: Owens-Corning Fiberglas Corporation, Dept. 97-E, Toledo 1, Ohio.

Kaylo and Fiberglas* now provide you with all-purpose industrial insulations from one reliable supplier.



*T. M. Reg. Owens-Corning Fiberglas Corporation
© Mfd. by Kaylo Div., Owens-Illinois Glass Co., Inc.

OVERHUNG ROTOR DESIGN

simplifies compressor installation and eliminates outboard bearing alignment problems

1 PERMANENT, BUILT-IN ALIGNMENT

Rotor support bearing cast integral with crankcase.

2 NO OUTBOARD BEARING

No alignment problems.

3 FLOATING ROTOR

While operating, rotor weight is supported on a cushion of magnetic force.

4 EASE OF INSTALLATION AND MAINTENANCE

Just set the stator down and slide it in place.

5 NO FLYWHEEL REQUIRED

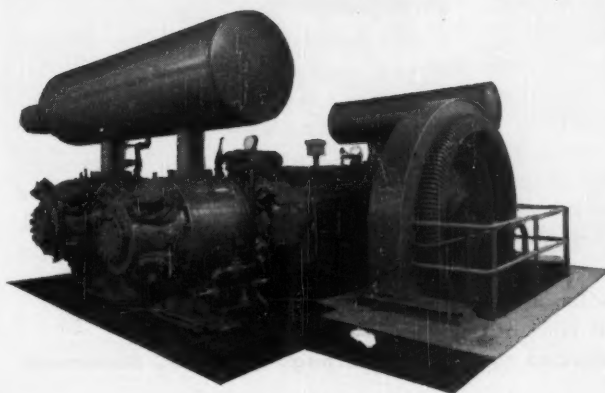
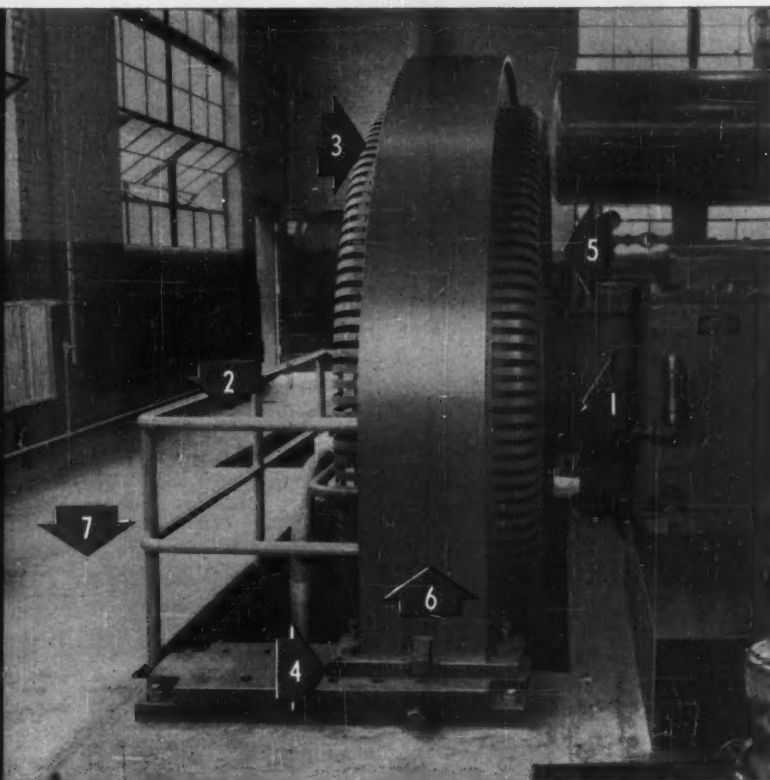
Flywheel effect built into rotor.

6 ONE-PIECE STATOR

Elimination of stub shaft and outboard bearing permits use of one-piece stator and collector rings.

7 SAVES FLOOR SPACE

Close coupling reduces foundation size and floor area.



CLARK BROS. CO. • OLEAN, N. Y.

ONE OF THE DRESSER INDUSTRIES
Sales Offices in Principal Cities throughout the World

PRECISION BY THE TON



balanced/opposed compressors
150-4500 HP

One of the many exclusive features of Clark Balanced/Opposed Compressors is the overhung rotor design.



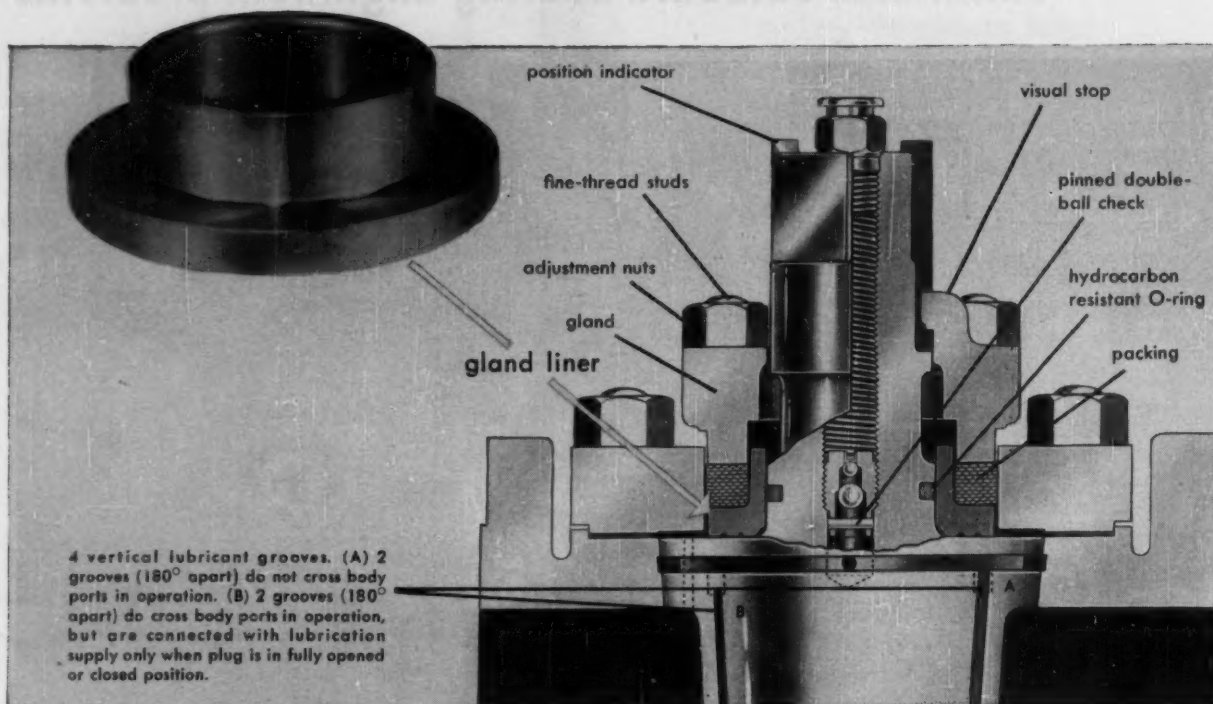
With it, compressor installation is greatly simplified, floor space requirements are substantially reduced and alignment problems (inherent with outboard bearings) are non-existent. Furthermore, elimination of the outboard bearing precludes bumping it out of alignment.

When the unit is operating, the magnetic lines of force fully support the rotor, with practically no weight carried by the integral bearing or shaft. Alignment is permanently built into Clark Balanced/Opposed Compressors.

For complete details on America's first and foremost Balanced/Opposed Motor-Driven Compressor—the compressor with *perfect balance*—write for Bulletin 118 and consult with your nearest Clark representative.

Because of this part . . .

- longer life
- less frequent adjustment



It's the gland liner . . . versatile component of the newly designed OIC Lubricated Plug Valve. It seals, reduces friction, helps extend packing life.

This liner forms an additional seal where its mating surfaces are lapped to the top of the plug. Machined from a special bronze—OIC Alloy 40—it has extremely low friction bearing characteristics, helping to make this valve easy to operate. It will not gall or seize.

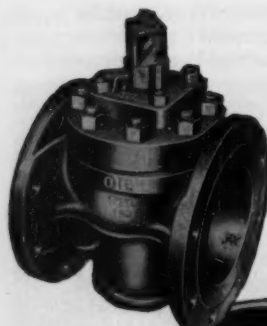
Note in the cutaway illustration that this gland liner completes isolation of the resilient packing from all rotating parts. The packing is not subjected to

undue wear, therefore, insuring proper plug loading without need for frequent gland adjustment.

Fine threads on the studs permit precise adjustment of the gland, further contributing to ease of operation and proper seating of the plug in the valve body.

Write for Bulletin 1003 giving complete data on this new OIC Lubricated Plug Valve design. Available in steel, 150 and 300-lb. pressure classes, sizes ½" to 12".

Order through your OIC Distributor.

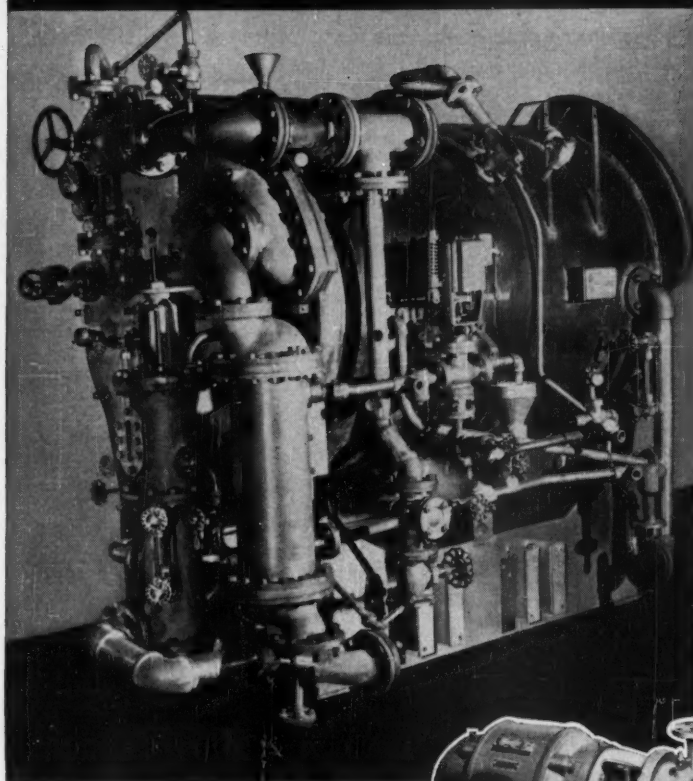


THE OHIO INJECTOR COMPANY • WADSWORTH, OHIO

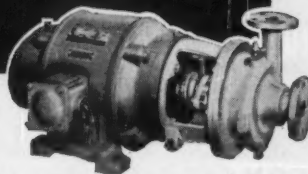
VALVES

**FORGED & CAST STEEL, IRON & BRONZE,
LUBRICATED PLUG VALVES**

CORROSION PROBLEMS evaporate



Salt water evaporator manufactured by Griscom-Russell Co., Massillon, Ohio. Ampco Metal is the principal component of construction.



Ampco Centrifugal Pumps resist corrosion, abrasion, cavitation erosion.

*Reg. U. S. Pat. Off.



AMP CO METAL, INC.

MILWAUKEE 46, WISCONSIN

West Coast Plant: BURBANK, CALIFORNIA

when you use
AMP CO^{*}
METAL
on your tough jobs!



Hot salt water is a corrosion headache in any man's language. And that's why sea-water evaporators manufactured by Griscom-Russell Co. of Massillon, Ohio are made principally of Grade 8 Ampco Metal.

Ampco Metal has exceptional resistance to corrosion from sea water — even brackish water and polluted harbor-water, as well as many other corrosive liquids. That's why it's so widely used in marine service, as well as chemical and process applications.

That's not the only reason Grade 8 Ampco Metal was selected for this tough service: It adapts to complicated shapes — it's easy to fabricate with Ampco-Trode[®] welding wire or covered electrodes. Weight is saved — this evaporator is 10% lighter than previous units, with even further weight reductions possible.

Complete the story yourself! Find out how Ampco Metal can help you save production time, trouble, and money — how it gives you corrosion-, erosion-, abrasion-proof service in hundreds of applications.

You get Grade 8 Ampco Metal in practically any form you require: sheets, plates, extrusions, castings, pipe, fasteners, etc. Check with your nearest Ampco field engineer or send the coupon today for more information.

Tear out this coupon and mail today!

AMP CO METAL, INC.

Dept. CE-3, Milwaukee 46, Wisconsin

Send me information of the application of Ampco aluminum bronzes for corrosion-resistant application in marine service.

Name.....Title.....

Company.....

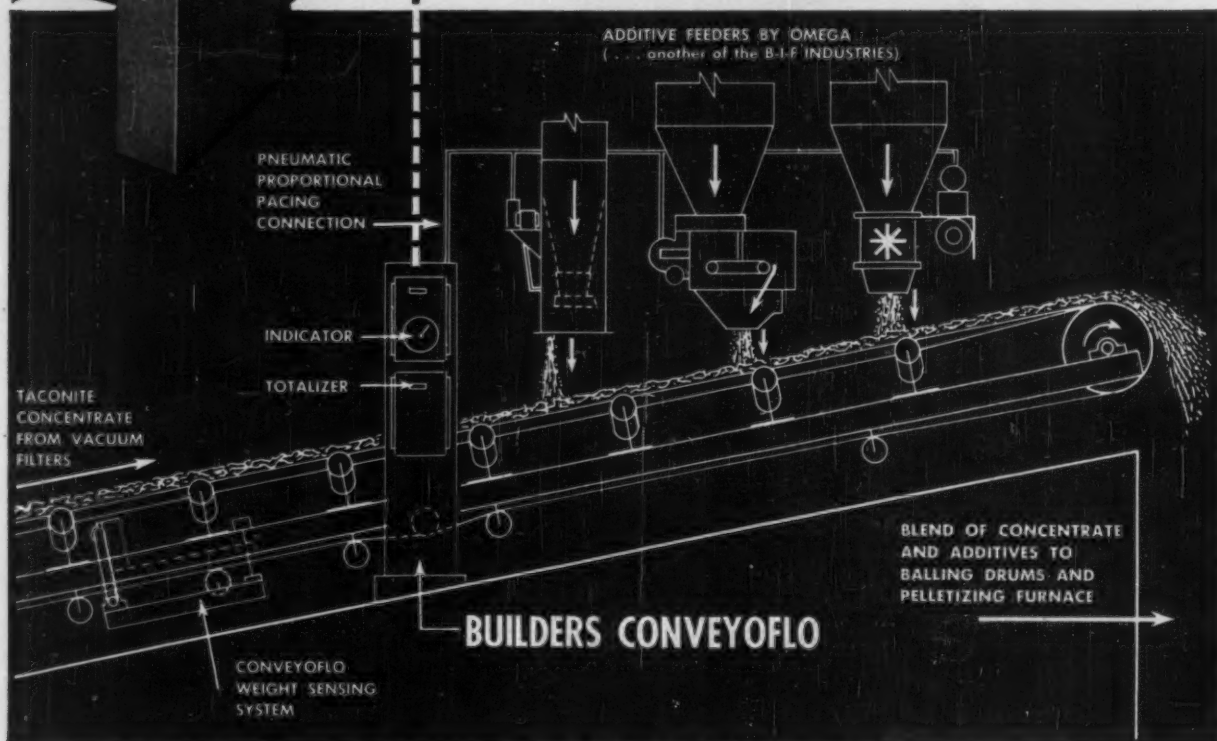
Company Address.....

City.....() State.....

ME-6

AUTOMATION TAKES OVER TACONITE PROCESSING WITH . . . **BUILDERS CONVEYOFLO**

To handle the millions of tons of ore processed in the modern taconite plant requires the latest in high-speed, high-accuracy processing equipment. See in this flow diagram how Conveyoflo's pneumatic weight sensing system is ready-built to pace auxiliary additive feeders to produce the proper blend for the pelletizing process. Then see for yourself how Conveyoflo can help simplify and systematize your continuous processing operations. We welcome your inquiry.



CONVEYOFLO FEATURES

- **ACCURATE** . . . within $\pm \frac{1}{2}$ of 1% of actual weight from maximum to 50% of rated capacity; within 1% from 50% to 25% rate; within 2% from 25% to 10% of meter's rated capacity.
- **COMPACT** . . . weight sensing mechanism completely contained within conveyor structure.
- **AUTOMATIC TOTALIZER COMPENSATION** for variations in belt speed and belt weight.
- **RESPONDS ACCURATELY** to rapid load variations.
- **PACES AUXILIARY EQUIPMENT** and operates secondary totalizers, indicators, recorders.



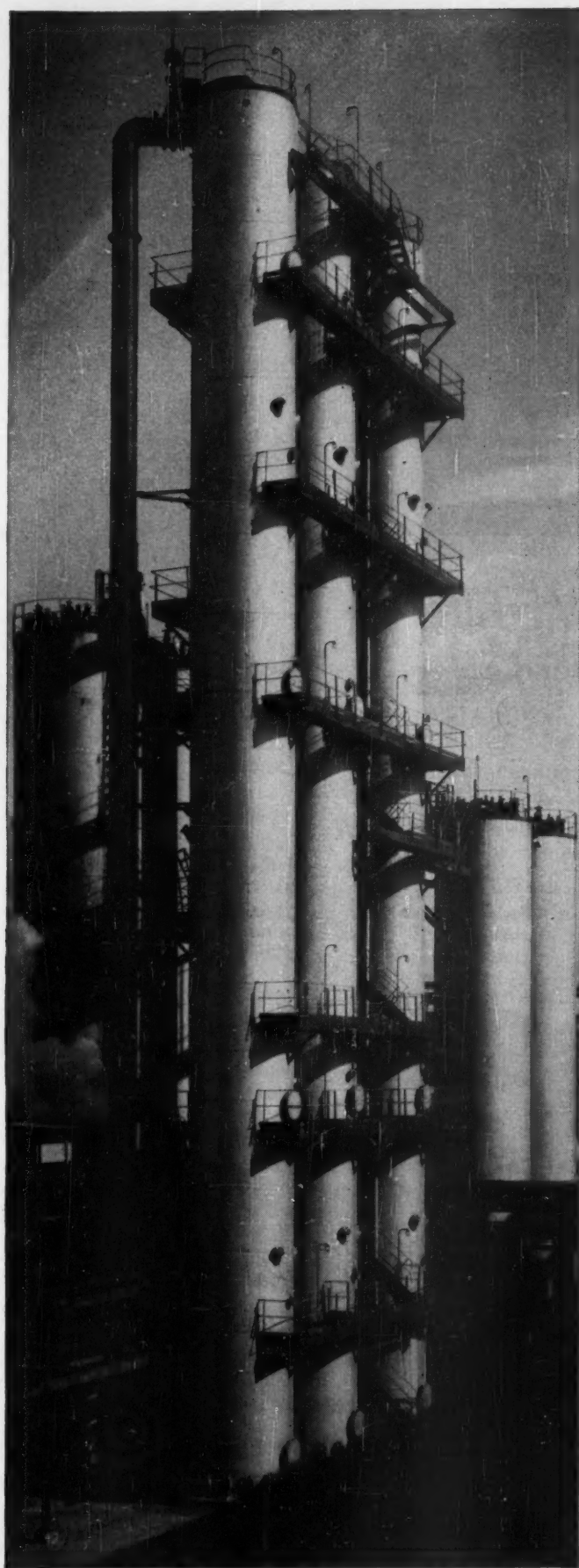
Bulletin 550-H4A gives full details on Conveyoflo. For your copy, write Builders-Providence, Inc., 369 Harris Ave., Providence 1, R. I.

BUILDERS-PROVIDENCE

DIVISION OF B-I-F INDUSTRIES, INC.
BUILDERS IRON FOUNDRY • PROPORTIONEERS, INC. • OMEGA MACHINE CO.



METERS
FEEDERS
CONTROLS



GRAVER

Gas and Chemical "scrubbers" for Great Lakes Steel

(DIVISION OF NATIONAL STEEL CORPORATION)

At Great Lakes Steel Corporation's Blast Furnace Division, a new by-product coke plant is equipped with a total of 25 large examples of Graver's craftsmanship in steel.

These structures, shop-fabricated at Graver's East Chicago plant and field-erected on the site by Graver crews, were built to the designs of Wilputte Coke Oven Division, Allied Chemical & Dye Corporation. These include bins, stacks, gas coolers, tanks for chemical feed, storage, and settling—and scrubbers such as the three 132' towers shown at the left.

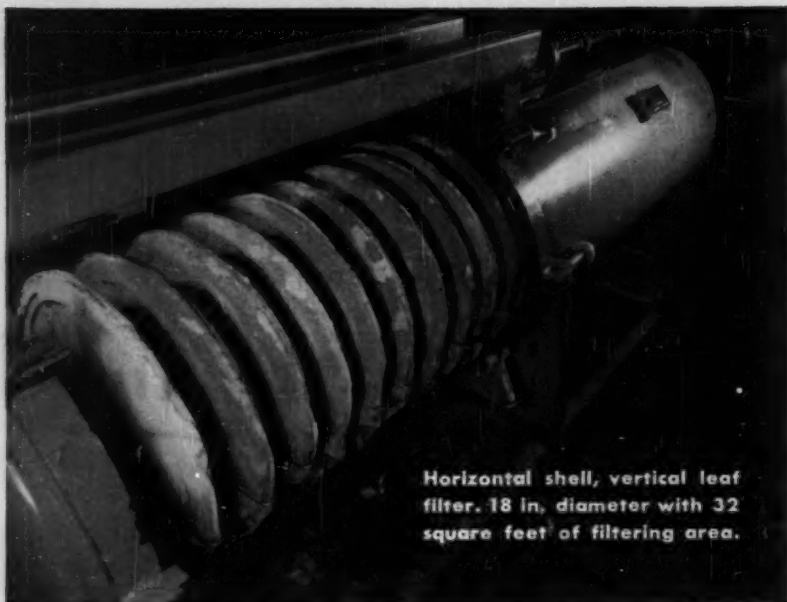
This variety of quality fabrication indicates Graver's versatile craftsmanship—demonstrates Graver's ability to shop-fabricate and field-erect structures for the steel, petroleum and chemical industries. For process and storage equipment in steels, alloys or clads, Graver's offices across the country are staffed with competent engineers ready to serve you.

GRAVER ...craftsmen in carbon,
stainless and alloy steels

GRAVER TANK & MFG. CO., INC.

EAST CHICAGO, INDIANA

CHICAGO • NEW YORK • PHILADELPHIA • FONTANA, CALIF. • DETROIT
CLEVELAND • PITTSBURGH • HOUSTON • CATASAUQUA, PA.
SAND SPRINGS, OKLA. • CASPER, WYO. • ODESSA, TEXAS
LOS ANGELES • EDGE MOOR, DEL. • TULSA • SAN FRANCISCO



Horizontal shell, vertical leaf filter. 18 in. diameter with 32 square feet of filtering area.

This horizontal INDUSTRIAL Filter helped increase Hoffman lard sales

PROPER FILTRATION • BETTER PRODUCT • MORE SALES

Hoffman Brothers Packing Co., Los Angeles, found this filter a definitely profitable buy. They say that sales have increased to full production limit with the improved product,

12,000 POUNDS OF LARD FILTERED BETWEEN CLEANINGS

The moderate size filter recommended by Industrial does a huge job. 5000 lbs. of lard is first run through the filter at 180°F. to remove the cracklings. Then 7000 lbs. of suet is processed at 200°F., filtering out cracklings and activated clay. The entire 12,000 lbs. of clear filtrate is produced before the filter is opened and cleaned.

"LIFT-OUT" LEAVES ARE EASY TO CLEAN

Industrial's horizontal filters can be opened and cleaned with unusual speed and convenience. The leaves are simply lifted out without any unfastening operation, cleaned, and dropped back into place.



INDUSTRIAL MAKES VERTICAL AND HORIZONTAL FILTERS IN MANY SIZES

A wide range of filters, from 3½ to 1950 square feet of filtration area, are available in materials and types suitable for any chemical processing. Industrial's research and engineering staffs are ready to help you with your problems.

Write for full details



INDUSTRIAL
FILTER & PUMP MFG. CO.

5924 Ogden Avenue • Chicago 50, Illinois

CENTRIFUGAL PUMPS • PRESSURE FILTERS • ION AND HEAT EXCHANGERS • RUBBER LININGS • WASTE TREATING EQUIPMENT



'scuse us
for being chesty, but...

... we just can't help crowing about reader-response to CE's first *Annual Inventory Issue*.

A chemical engineer from Brooklyn calls it . . . "invaluable already, and without precedent." A South Carolina plant manager stopped in to tell us . . . "Yo'all done yo'self real proud." A Dallas man swears . . . "the editor musta come from Texas."

Others went into greater detail—on content, arrangement of editorial sections, Reader Service—even the quality of the advertising. Comments and opinions were all over the lot. And they're still coming in.

What do you say? It's your magazine and we're wide open for suggestions. We'd like your ideas . . . for the *1955 Annual Inventory Issue* of **CHEMICAL ENGINEERING**.

ANNUAL INVENTORY ISSUE

Chemical
Engineering



A McGraw-Hill Publication, 330 W. 42nd St., New York 36, N. Y.

May 1955—CHEMICAL ENGINEERING

U.S.I. CHEMICAL NEWS

★ A Series for Chemists and Executives of the Solvents and Chemical Consuming Industries ★

NEW POLYETHYLENE PLANT ON-STREAM

National Distillers Announces 2 Appointments

Dr. Hulse Named Director



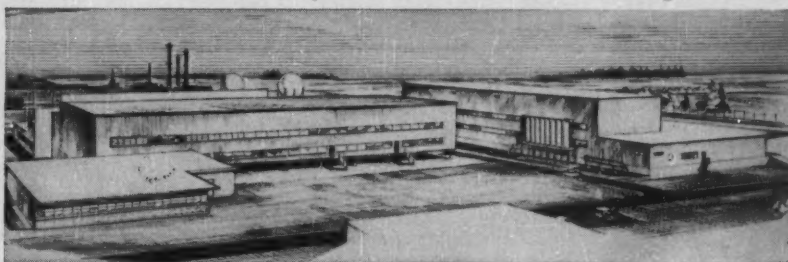
National Distillers Products Corporation has recently announced the appointment of Dr. R. E. Hulse as a member of the company's Board of Directors. Dr. Hulse is Vice President in charge of all National's Chemical Activities. This includes the U.S.I. Division which produces and markets industrial alcohol; solvents; chemicals (including metallic sodium, sulfuric acid, anhydrous ammonia); polyethylene; and feed supplements. Dr. Hulse also serves as Vice President and Director of National Petro-Chemicals Corporation, the 60% owned subsidiary managed by National Distillers.

Vincent McCarthy to Direct Polyethylene Sales

In another recent announcement, Mr. Vincent McCarthy was appointed sales manager of "PETROTHENE" Polyethylene Resins for U. S. Industrial Chemicals Co., Division of National Distillers Products Corporation. Mr. McCarthy formerly was sales manager of extruded polyethylene products for Gering Products, Inc. His background embraces the entire thermoplastic raw materials field. Under direction of L. A. Keane, U.S.I. sales Vice President, Mr. McCarthy will supervise all polyethylene sales activities of U.S.I. Division Offices covering all major marketing areas.



Integrated plant yields resin with consistent, controlled properties; Product to be marketed by U.S.I.'s nationwide sales organization.



Artist's drawing of National Petro-Chemical's new polyethylene plant, Tuscola, Ill.

SPECIAL NOTICE

Government Permits No Longer Required for Ethyl Acetate

As of January 1, 1955, all restrictions on the use of ethyl acetate have been removed, and denaturation of ethyl acetate no longer will be required. This is in accordance with U. S. Treasury Decision 6117, published in the Federal Register, Volume 19, Number 253, Part 2, Section 1.

This removal of regulations places ethyl acetate in the same category with any other ordinary chemical product, such as acetone, and manufacturers wanting to use or ship ethyl acetate of any grade no longer need obtain government permits and approval to do so.

Two grades of medium flow polyethylene resins are now being produced at a new plant in Tuscola, Illinois, it was announced by National Petro-Chemicals Corporation, and its two parent companies, National Distillers Products Corporation and Panhandle Eastern Pipeline Company. It is estimated that production during the first year of operation will be in excess of 26 million pounds. This plant is the most recent addition to the huge petrochemical facilities owned and operated by Petro at the same plant site. The plant is based on an I.C.I. process, modified by Petro to meet specific requirements of the plastics industry and it produces a high molecular weight polyethylene resin. Because of the integrated nature of the operation, a high-quality polyethylene resin is produced with consistent, controlled physical properties.

To Be Marketed by U.S.I.

Petro's polyethylene resins, under the trademark name "PETROTHENE", are being marketed through the nationwide sales organization of U. S. Industrial Chemicals Co., a Division of National Distillers Products Corporation. "PETROTHENE" resins are available in grades suitable for extrusion, compression, and injection molding, for use in the manufacture of films, bottles, pipe, etc. U.S.I. has sales offices in most major cities and warehousing facilities are being established in East Coast, Midwest and West Coast plastics market areas to assure prompt delivery to customers. "PETROTHENE" molding powder comes in cube form and is available in all quantities from 50 pound bags to carloads.

Made from natural gas

As shown in the flow diagram on the next page, the starting point in the production of "PETROTHENE" resins is natural gas pumped from two converging pipelines by Panhandle Eastern's Tuscola compressor station. Hydrocarbon extraction is the first step. Hydrocarbons are then liquefied under pressure and fractionated into ethane and by-product propane, butane and natural gasoline. The ethane is converted by "cracking" into

MORE



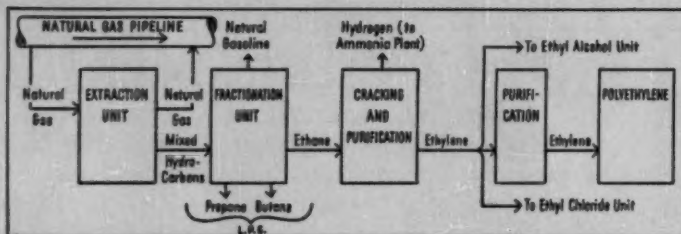
January 21 marked the dedication of U.S.I.'s new ammonia plant at Tuscola, Ill. A model tank car was presented to Central Illinois Fertilizer Co., to represent delivery by U.S.I. of the first car of anhydrous ammonia for direct application to the soil. Attending the dedication and shown above, left to right, are: John E.

Bierwirth, President National Distillers Products Corp.; Dr. R. E. Hulse, National Distillers Vice President and General Manager of National's U.S.I. Division; Dr. K. D. Jacob, U.S.D.A.; D. J. Patterson, U.S.I. Tuscola Plant Manager; C. R. Ware, President, Central Illinois Fertilizer Co.; Fred Jones, Mayor of Tuscola, Ill.

U.S.I. CHEMICAL NEWS

CONTINUED

New Polyethylene Plant On-Stream



"Petrothene" polyethylene resins are made from natural gas as shown in this flow diagram.

ethylene and byproduct hydrogen. The ethylene is purified by low temperature distillation and feeds into the polyethylene unit for conversion into "PETROTHENE" resins.

Capacity can be expanded

According to Dr. Robert E. Hulse, Vice President of Petro, the new unit can be greatly expanded above its current production rate of 26 million pounds of polyethylene. The unit was designed for this future possibility, to insure a steady source of supply to customers in an expanding market.

In addition, the size of the laboratory facilities at Tuscola have been doubled to assist "PETROTHENE" customers with new developments and processing problems, as well as to provide the processing quality control necessary for a high-grade product.

Additional information is contained in the new "PETROTHENE" booklet. Copies sent upon request to Editor, U.S.I. Chemical News.

Methionine Alleviates High Altitude Anoxia

During recent studies, medical researchers found that human beings showed greater resistance to high altitude anoxia (oxygen deficiency) after injections of cysteine—one of the sulfur containing amino acids which can be derived from methionine in the body. Because of its expense and other considerations, cysteine is not used in practical work. However, biologically it can be supplied by administration of its precursor, methionine.

These research findings tend to confirm and add support to the view that cysteine and its precursor, methionine, play a definite and important role in preventing or alleviating the adverse effects of many different stress factors and extremes in environment.

Organosodium Compounds Opening New Frontiers

Organosodium compounds prepared from sodium dispersions are opening new, economical routes to the synthesis of phenylacetic acid, dimethyl phenylmalonate, benzophenone, and many others, including organotin, -phosphorus and -silicon products.

The organosodium compounds are prepared by reacting organic compounds with dispersed sodium. Phenyl sodium, for instance, is made by metering chlorobenzene into the sodium dispersion. The minute particles permit the reaction to start immediately and to produce high yields. Aliphatic, aromatic and heterocyclic derivatives can be

formed in this manner.

Sodium dispersions are suspensions of microscopic sodium particles (10-20 microns) in various hydrocarbons, such as toluene, xylene or kerosene. High speed agitation is used to disperse the molten sodium in the liquid hydrocarbon. These organosodium compounds can be made in any size vessel from a liter flask to a 1000 gallon reactor.

For detailed information, write for U.S.I.'s Sodium Dispersion Booklet. Free copies on request to Editor, U.S.I. Chemical News.

TECHNICAL DEVELOPMENTS

Information about manufacturers of these items may be obtained by writing U.S.I.

Many and varied uses are seen for a wide spectrum chemical (ethyl carbamate) with applications ranging from medicine to industry. Reacts with organic or inorganic compounds to form intermediate or end products of commercial importance. (No. 1080)

Pressure sensitive adhesive in a ball point dispenser for plant, office, school and home use is now on the market. It is said to bond paper to paper easily, yet make it possible to peel glued sheets apart whenever desired. (No. 1081)

Irradiated polyethylene samples for testing can now be bought. Maker reportedly will fill specifications for test lengths of tubes, extruded shapes, or rods. (No. 1082)

Seeds get off to fast, healthy starts when planted in hollow-center cubes of plant food material. Ideal for flower, vegetable seeds, these new cubes reportedly make planting, transplanting easier and more successful. (No. 1083)

Use of Vaccenic acid, trans-11-oic acid, with its higher melting point and resistance to rancidity, reportedly will produce new aldehydes, acids, and other compounds of value in food, cosmetic, and industrial applications. (No. 1084)

New flexible labels for polyethylene squeeze bottles are said to give with bottle, yet return to its original shape when pressure is released. Applicable with conventional methods and equipment, the new labels are claimed to make possible real color and design in squeeze-bottle packaging. (No. 1085)

A "tamed" iodine germicide, that won't stain, sting or poison, is described as effective even in highly dilute solution against a wide range of micro-organisms, including polio virus and influenza virus. (No. 1086)

A powerful, completely nonstaining rubber antioxidant, of special interest for white or light-colored goods, shows retention of tensile strength after accelerated aging, the manufacturers state. (No. 1087)

To impart fire-retardant properties to latex-base paints, a new borate compound has been developed. (No. 1088)

New stabilizer and antiskinning agent for paint has high surface activity reported to keep heavy pigments in suspension. No milling with pigment paste required, just add to finished paint before viscosity adjustment is made. (No. 1089)

PRODUCTS OF U.S.I.

ALCOHOLS

Butanol (Normal-Butyl Alcohol)
Fusel Oil — Refined

Ethanol (Ethyl Alcohol)

Specially Denatured—all regular and anhydrous formulas
Completely Denatured—all regular and anhydrous formulas
Pure—190 proof U. S. P., Absolute—200 Proof
Seloxy—proprietary solvent—regular and anhydrous

ETHERS

Ethyl Ether, U. S. P.
Ethyl Ether, Absolute—A.C.S.

ACETONE—A.C.S.

ANOLS

Ansol® M
Ansol® PR

ACETIC ESTERS

Butyl Acetate
Ethyl Acetate—all grades
Normal-Propyl Acetate

OXALIC ESTERS

Diethyl Oxalate

OTHER ESTERS

Dialol®
Diethyl Carbonate

INTERMEDIATES

Acetoacetaldehyde
Acetoacetal-ortho-chloroanilide
Acetoacetal-ortho-toluidide
Acetoacetal-para-chloroanilide
Ethyl Acetoacetate
Ethyl Benzoylacetate
Ethyl Sodium Oxalacetate

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Calcium Pantothenate (Feed Grade)
Choline Chloride Products
Curbay B-G* 80
DL-Methionine (Feed Grade)
Niacin, U.S.P.
Riboflavin Concentrates
Special Liquid Curbay*
U.S.I. Vitamin B₁₂ and
Antibiotic Feed Supplements
Vitalone® 40
Vitamin A, D₂, and K₂ Products

PLASTICS

Petrothene® Polyethylene Resins

OTHER PRODUCTS

Anhydrous Ammonia
Caustic Soda
Ethylene
Liquid Chlorine
Metallic Sodium
DL-Methionine (Pharm.)
N-Acetyl DL-Methionine
Nitrogen Solutions
Propionic Acid
Sulfuric Acid
Urethan, U.S.P.

*Reg. U.S. Pat. Off.
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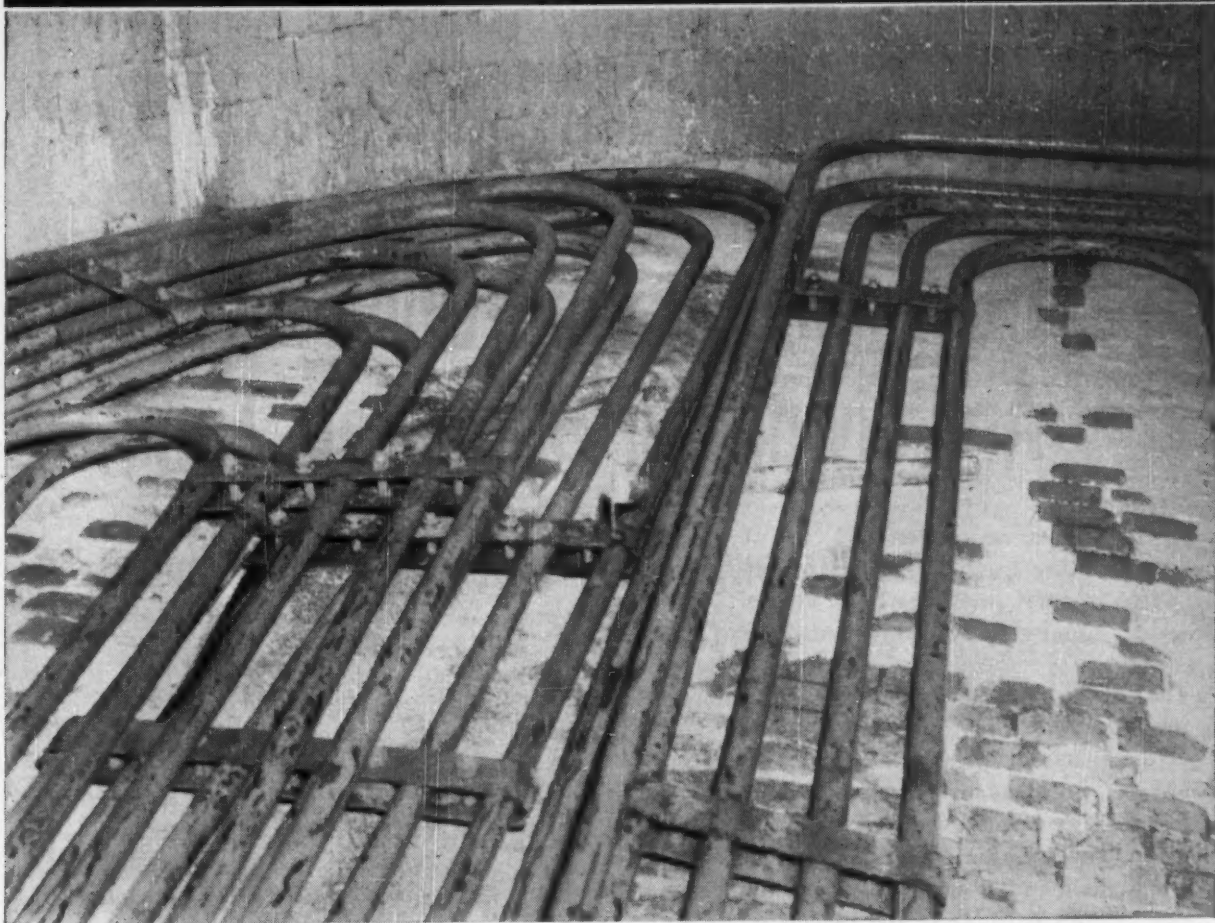
U.S.I. INDUSTRIAL CHEMICALS CO.

Division of National Distillers Products Corporation

99 PARK AVENUE, NEW YORK 16, N. Y.

BRANCHES IN ALL PRINCIPAL CITIES

Alum Evaporator Coils of *Carpenter* Stainless No. 20Cb



Life Expectancy 25 Years...Trouble-Free!

A large chemical manufacturing company had a problem with heating coils for alum solutions of 8½ to 17%, at temperatures from 115 to 120°C. Continual repairs were needed, costly time-consuming down-time was frequent, steam leaks into the solution made quality almost impossible to maintain.

They switched to Carpenter Stainless No. 20Cb tubing for coils . . . to Carpenter Stainless No. 20 bar and strip for braces, hangers and fasteners. Down-time and coil repairs are a thing of the past. Steam leaks have been eliminated. Corrosion rate is estimated at .001" penetration per year. A useful life of 25 years or more is expected of these coils!

Are severe corrodents, including sulphuric and other strong acids, eating up costly equipment and production time in your plant? Perhaps the super corrosion resistance of Carpenter Stainless No. 20 and No. 20Cb can be a cost-cutting trouble-saver for you, too. It's available in 8 different forms* from...

The Carpenter Steel Company, Alloy Tube Division, Union, N.J.
Export Dept.: The Carpenter Steel Co., Port Washington, N.Y.—"CARSTEELCO"



*STANDARD FORMS AVAILABLE are tubing, pipe, sheet and plate of Carpenter Stainless No. 20Cb; strip, wire, bars, and billets of Carpenter No. 20. Ask for Bulletin 108A.

FINANCIAL AID TO HIGHER EDUCATION

Our Colleges and Universities Are Living on Borrowed Time

... time borrowed from underpaid faculty members

The chart on this page tells a story of profound importance to every American. It is the story of the financial beating our college and university faculty members have been taking in the past 14 war and postwar years.

On the whole, this span of 14 years has been one of great and growing prosperity. But, as the chart shows, our college and university faculty members have, as a group, had less than no share in it.

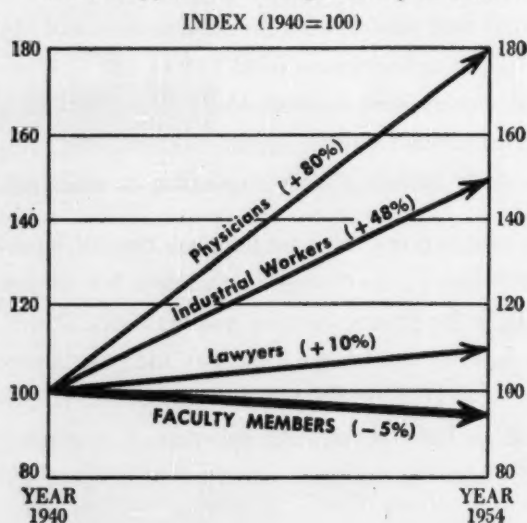
During this period, from 1940 through 1954, the real income of the average industrial worker (that is, what his wages would purchase in goods and services) has increased by almost one-half. Among professional groups, physicians have enjoyed an increase of about 80 per cent in their real income. Lawyers, far less favored financially, have had an increase of about 10 per cent. But faculty members have not only had no increase at all; over these years of prosperity their average real income has fallen by 5 per cent. These figures do not take account of the increase in taxes since 1940.

Senior Teachers Hardest Hit

These figures are, of course, averages. For some groups of faculty members it has been better; for others worse. It has been particularly

hard on senior faculty members. Between 1941 and 1953 their salaries lost about 8 per cent of their purchasing power. Being deeply committed to their careers they could not respond to alternative employment opportunities as readily as could their junior colleagues. For junior faculty members there was some increase in real income between 1941 and 1953 but only about half as much as the average for the nation.

What's Happened to College Faculty Salaries*



* Real Income before Taxes

Source: Council for Financial Aid to Education; U. S. Dep't of Commerce; U. S. Dep't of Labor.

Public Colleges Are Better

There are also marked differences in the average financial reward received by faculty members in different types of colleges and universities. A recent study by the Council for Financial Aid to Education indicates that, in the last academic year, 1953-1954, teachers in privately endowed, independent colleges and universities were paid an average salary about \$1000 less than that paid to faculty members in tax-supported institutions. The same study indicates that salaries far below the average are especially common for faculty members in the small private liberal arts colleges. This study found that during the last academic year the average salary of all college and university faculty members was about \$4700.

The special difficulties under which the independent colleges and universities, and particularly the independent liberal arts colleges, are laboring to get back on their feet financially have been discussed in previous editorials in this series. These difficulties underline the need of special help for these institutions to which business firms are now contributing in increasing volume. However, the problem of providing better salaries is not peculiar to any particular type of institution.

Faculty Members Not Greedy

It is not easy to prescribe a precise standard of fair pay for college and university faculty members. This is partly because they put less weight relatively on money rewards than they put on rewards of scholarly accomplishment and prestige. Consequently, they have consistently been willing to work for very modest salaries in relation to the intellectual ability, education and application required. Obviously, however, it is the dictate both of fairness and good judgment to see that faculty members are given a roughly proportionate share in the general prosperity. Indeed, their crucial role in our society could be made to justify a larger share than this.

There is no way to know with any degree of precision what the underpayment of our college and university faculty members over the past 14 years has actually cost the nation in terms of reduced quality of intellectual performance of those institutions. One reason is that the damage has been minimized by the devoted services

of many faculty members who have loyally stuck to their jobs in spite of the great financial discouragement.

It is obvious, however, that, if no grave deterioration in the intellectual performance of our colleges and universities has occurred so far, it is because we have been living on borrowed time. It is time borrowed from faculty members who have, in effect, been subsidizing these institutions by their financial sacrifice. This arrangement is not only a menace to the cultural and intellectual life of the nation, it is also a menace to our national security in a time when successful national survival may well depend in peculiar degree on the full development and utilization of our intellectual resources. We depend on our college and university faculties pre-eminently to provide this development. Adequate financial reward for such service is an elementary form of national insurance.

Many of our colleges and universities are working hard to improve the financial lot of their faculty members. Business firms are also playing an increasing role of providing the necessary financial assistance. The methods being used by business for this purpose will be the subject of another editorial in this series. However, **vastly more must be done, and quickly, to stop the financial beating being taken by our college and university faculty members if the nation's welfare and safety are to be properly protected.**

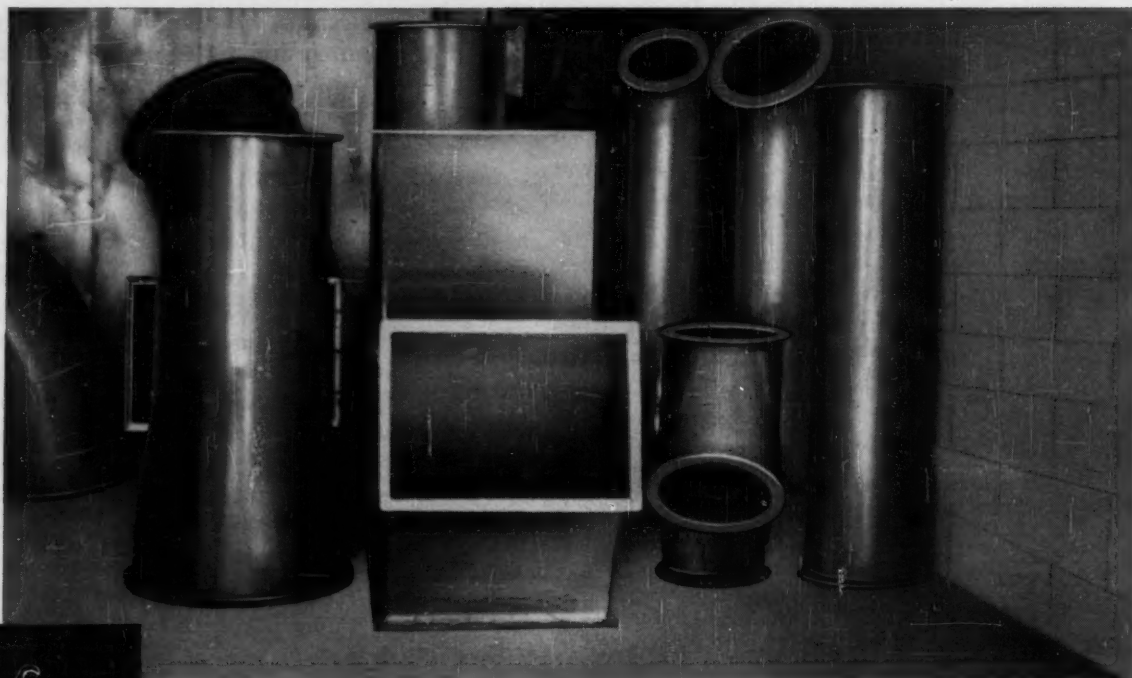
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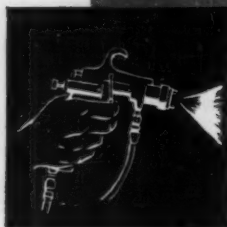
Donald C. McGraw
PRESIDENT

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Plastisol coatings can now do many more metal-protection jobs



Large ductwork protected with heavy duty Unichrome Plastisol Coatings. Photo courtesy Kaybar, Incorporated—Hazel Park, Michigan



Unichrome Coating 5300 *sprays on to give smooth coatings 20 mils thick or thicker*

Even large equipment can now be protected with plastisols. Unichrome Coating 5300 makes practical spray application of thick films. A short bake at 350° F turns this liquid, resinous material into a tough, rubbery and heavy duty vinyl film that makes ordinary metals fit for severest service conditions.

The first successful sprayable plastisol, Coating 5300 can be applied even to cold vertical surfaces in thicknesses up to 20 mils per dry coat. That's 5 to 20 times thicker than ordinary coatings. It assures protection free from seams, pores or "holidays".

And since Coating 5300 is a vinyl material, it withstands acids, alkalis, salt solutions, and a host of other chemicals and corrosives that attack ordinary coatings and the metals they are supposed to protect. Chemical inertness and

heavy film buildup join up in the right combination for durable metal protection.

Unichrome Plastisol Compounds are also available for dipping, troweling and other methods of application. More information on the advantages of plastisols in Bulletin VP-1. Send for it!

For protection you apply like paint...

Various UCILON® Coating Systems are available that can do some of the jobs plastisols can do... and many that plastisols cannot do, especially on large structural work. Ucilon Coatings include vinyl, phenolic, fish oil, Neoprene, Thiokol, and chlorinated rubber types. Bulletin MC-8 gives details.

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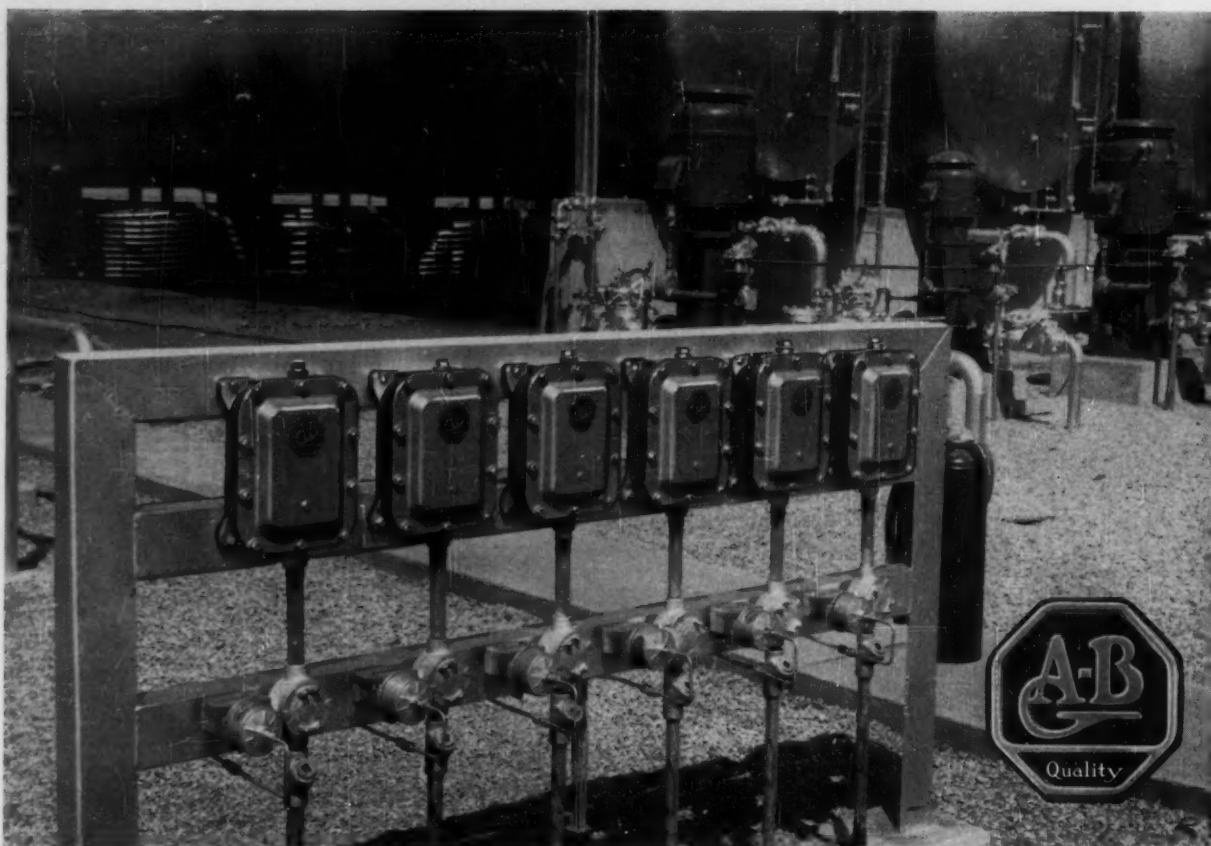
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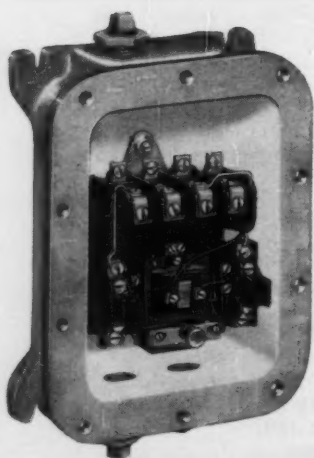
COMPANY

CITY.....STATE.....



A row of six Allen-Bradley Bulletin 709 automatic explosion-proof starters on loading pumps of an L.P.G. processing plant

FOR SAFE AUTOMATIC MOTOR OPERATION in Hazardous Locations *Specify* Allen-Bradley Explosion-proof Solenoid Starters



Bulletin 709 Solenoid Starter
Allen-Bradley Size 1 solenoid starter in a NEMA Type 7 enclosure for operation in hazardous gas locations. The cover and base have wide machined flanges.

It takes a lot of maintenance time to open and replace bolted covers of explosion-proof starters. That's why it is important to specify Allen-Bradley solenoid starters . . . which are good for millions of operations without contact maintenance. The thermal overload relays can be reset without opening the enclosure.

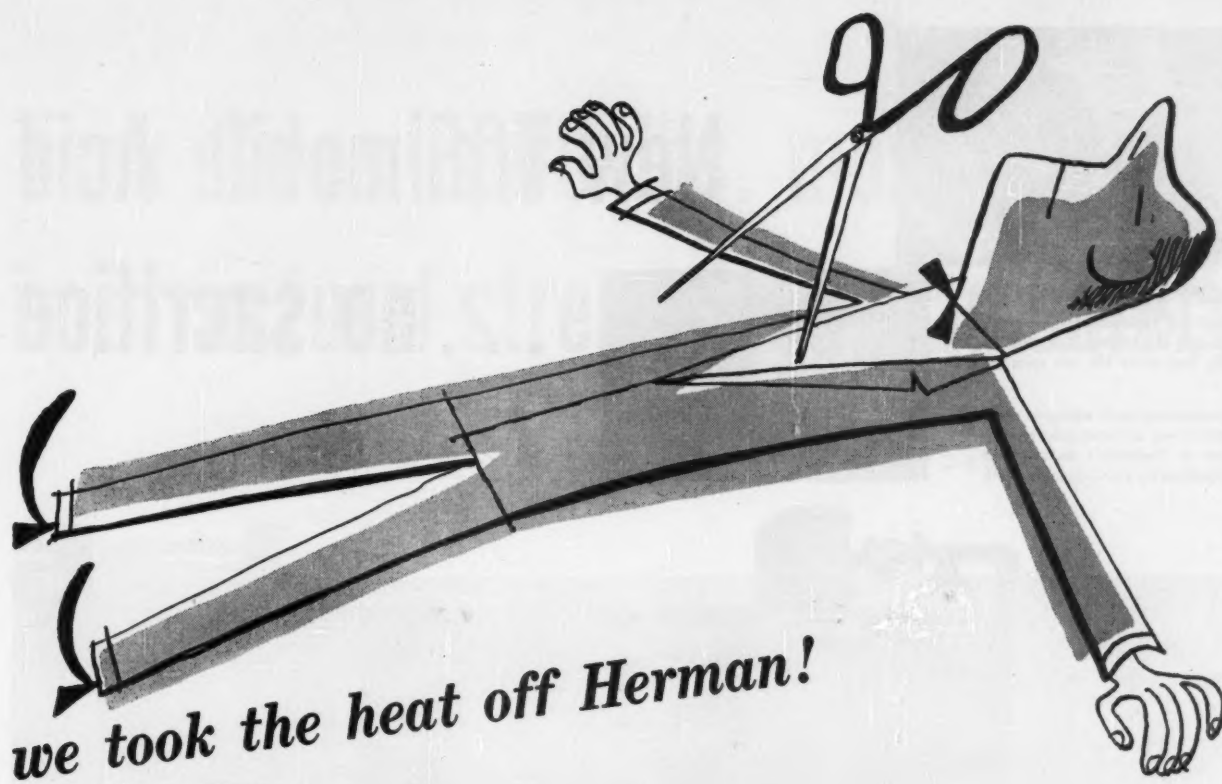
Reduce your plant maintenance by using Bulletin 709 solenoid starters. You can install them . . . and forget them. Write for the Allen-Bradley Handy Catalog . . . a valuable guide for selecting motor controls and enclosures for every type of industrial service.

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ALLEN-BRADLEY
SOLENOID MOTOR CONTROL



Double Break, Silver Alloy Contacts
Arc hood lifted to show double break, silver alloy contacts on solenoid plunger and in arc hood. The basic solenoid design of all Bulletin 709 ratings is identical.



Saved him from a horrible end, he says. From what Herman, a refinery supervisor down Houston way tells us, CE's *Inventory Issue* kiboshed a CPI tragedy right in his own home.

Seems his wife was pretty proud of her sewing. So was Herman — always talking it up at the plant about how much dough she saved on clothes. Only trouble was, she just had one pair of scissors, and Herman was forever borrowing 'em to cut out reading material from **CHEMICAL ENGINEERING**.

The day the *Inventory Issue* arrived though, he knew his snippers-snitchin' days were over. Saw right away how it wrapped up 12-months' key developments and eliminated his clip-and-file system in one fell swoop. New technologies, new plants, new chemicals and equipment, that wonderfully convenient Reader Service . . . *the works!* He was in ecstasy.

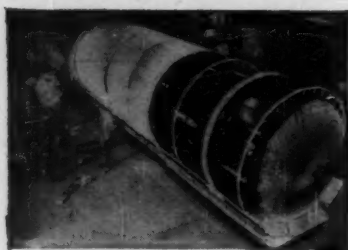
Couldn't understand when he told his wife about it though. She just up and fainted. Later, he keeled over himself when he found out she'd planned a scissorcide the next time he grabbed her shears.

But all's well now. A little vacation did the trick for mama. Today there's no happier CPI couple east of the Pecos. No snips around the house though — the little lady's clothes are all store-bought. And the only bragging Herman does at the plant is about *how much time he saves* . . . with the *Annual Inventory Issue* of **CHEMICAL ENGINEERING**.

ANNUAL INVENTORY ISSUE

Chemical  
Engineering

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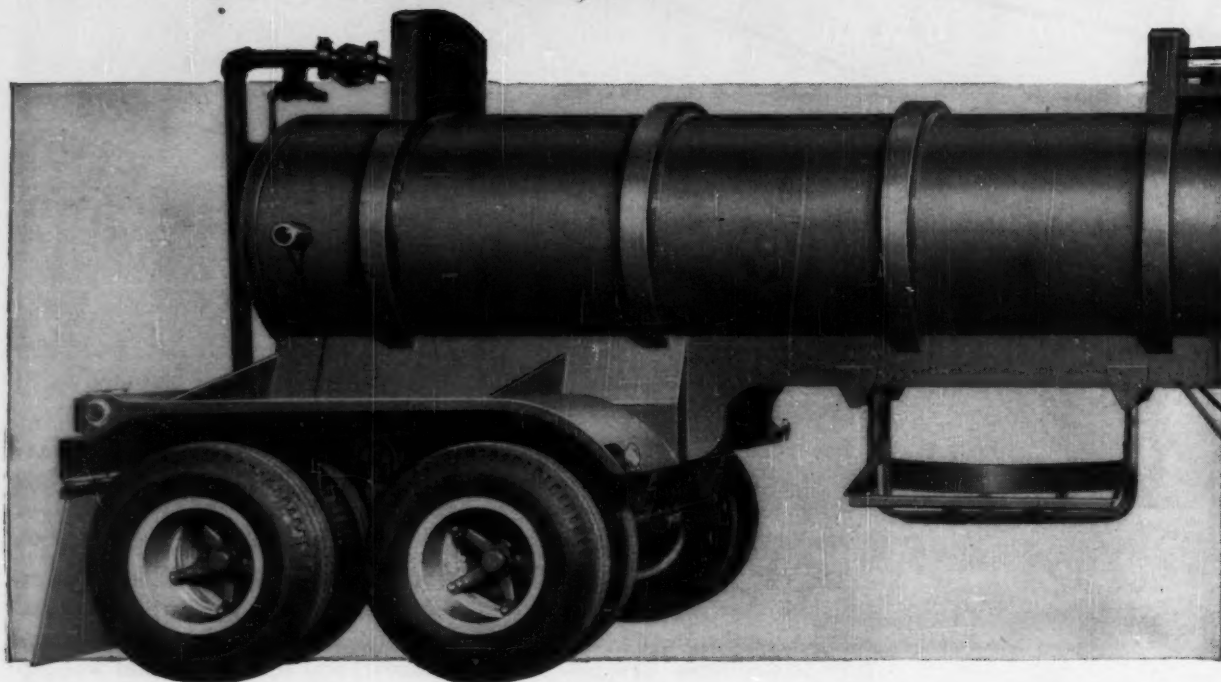


↑
Rigid and continual inspection during assembly of Trailmobile Acid Tanks assure long service life, safe operation.

Continuous automatic weld areas can be seen on new acid tank under construction at Trailmobile's exclusive tank manufacturing plant, Springfield, Mo. →



New Trailmobile Acid ... no sacrifice



You can haul more in Trailmobile's new "slimmed down" Model CH Acid Tank Trailer. Model CH is lighter by thousands of pounds, without sacrifice of structural strength, load safety or road handling ease.

Trailmobile's weight-reducing secret is a strong tank shell of $\frac{3}{16}$ " A.S.M.E. Code Steel, girded by husky "rings of steel." Strong channel members (we call them exterior rings) are

welded integrally to the tank shell and sturdy supporting frame members. Result? Overall structural strength equal to all previous regulations! Amazing weight reduction!

This exclusive new Trailmobile Model CH design (approved by I.C.C. Specification MC-311) gives operators extra payload carrying capacity of over 100 pounds for every 100 gallons of capacity built into a tank. A 3000 gallon capacity

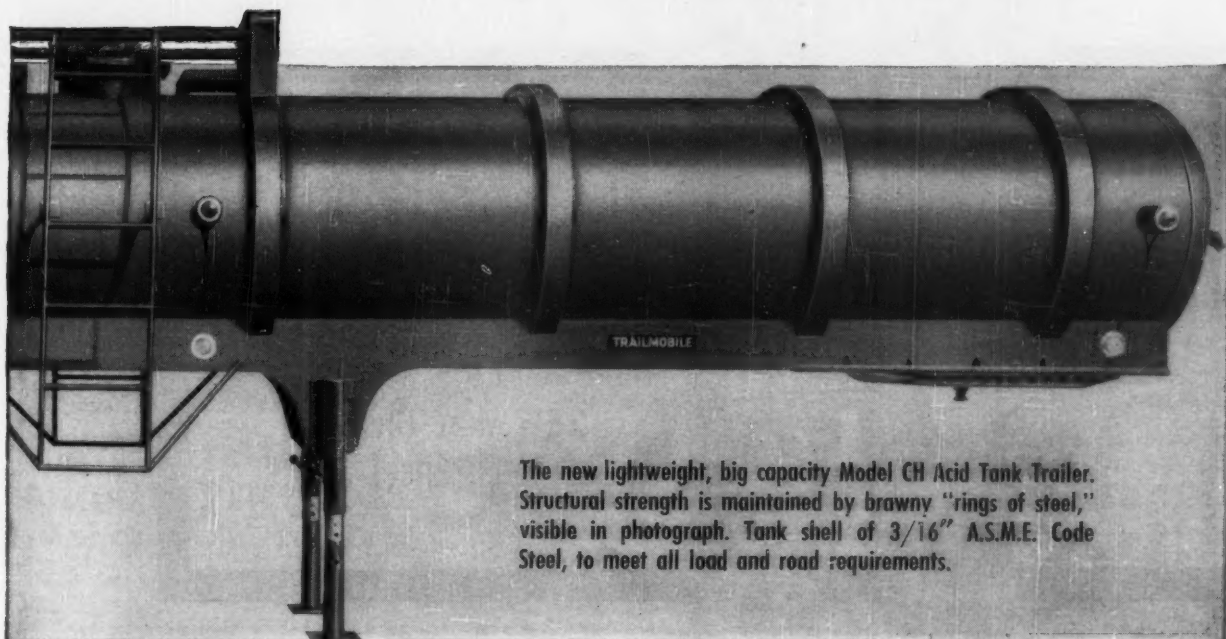


Model CH — insulated (optional)

Trailmobile continues to build heavier gauge tank trailers. Acid tanks are available in many sizes, shapes and designs with special and optional equipment to handle exact hauling problems. Ask about these special tanks.

Tank Gives 3000 lbs. more payload in structural strength or road safety

Available in A. S. M. E. Code Steel or Stainless Steel



The new lightweight, big capacity Model CH Acid Tank Trailer. Structural strength is maintained by brawny "rings of steel," visible in photograph. Tank shell of 3/16" A.S.M.E. Code Steel, to meet all load and road requirements.

Available with unground welds at reduced cost. Also built with stainless steel tank.

tank weighs almost 3300 pounds less than before. You get a bonus of 3300 pounds more payload! What's more, the new Model CH acid tanks encompass every money-saving performance feature of previous Trailmobile models: Walkway mounting brackets; adjustable fifth wheel; full Class A vapor-proof enclosed wiring; wide tunnel drains for easy cleaning; the famous Trailmobile tandem, with 4', 6' and 9' options.

Trailmobile manufactures the Model CH Acid Tank in either stainless or black steel, and with a variety of coatings and linings to handle all types of corrosive and non-corrosive fluids. So whatever your acid hauling problem, see Model CH before you buy. It's your assurance of increased hauling capacity, with utmost safety, economy and profit.

For full information and quotations on the Model CH and other Trailmobile acid tank trailers, mail coupon today. Or call your nearby Trailmobile Branch Office, listed in the yellow pages of your telephone directory.

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The Trend
is to **TRAILMOBILE**

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TRAILMOBILE INC.

I would like full information and quotations on the Model CH and other Trailmobile acid tank trailers.

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COMPANY _____
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Protective Clothing

NOW..

... Better Than Ever
the complete **AO[†]** line of
NEOPRENE
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CLOTHING

Typical of AO Neoprene "Protectocote" is this 902 SUIT JACKET. Storm front. 30" long from collar to tail. Solid brass button fasteners. Standard corduroy lined collar with male portion of studs for attaching a 921 hood.

New Improved Compound...
New Technique of Applying
Coatings gives **25%** more
Tear Strength — **30% to 40%**
More Abrasion Resistance —
25% More Chemical
Resistance!

For "Strength without Bulk" Protection against

A new compound combined with a new method of application has added 25% to the tear strength and chemical resistance of each garment. Abrasion resistance increase is even greater — 30% to 40%! The complete line now includes aprons, coats, suit jackets, pants, one-piece cover-all suits, hats, hoods, police raincoats and caps, utility bags, lineman's rain suits, sleeves, spats, hip leggings and neoprene blankets and curtains. YOUR NEAREST AO SAFETY PRODUCTS REPRESENTATIVE CAN SUPPLY YOU.

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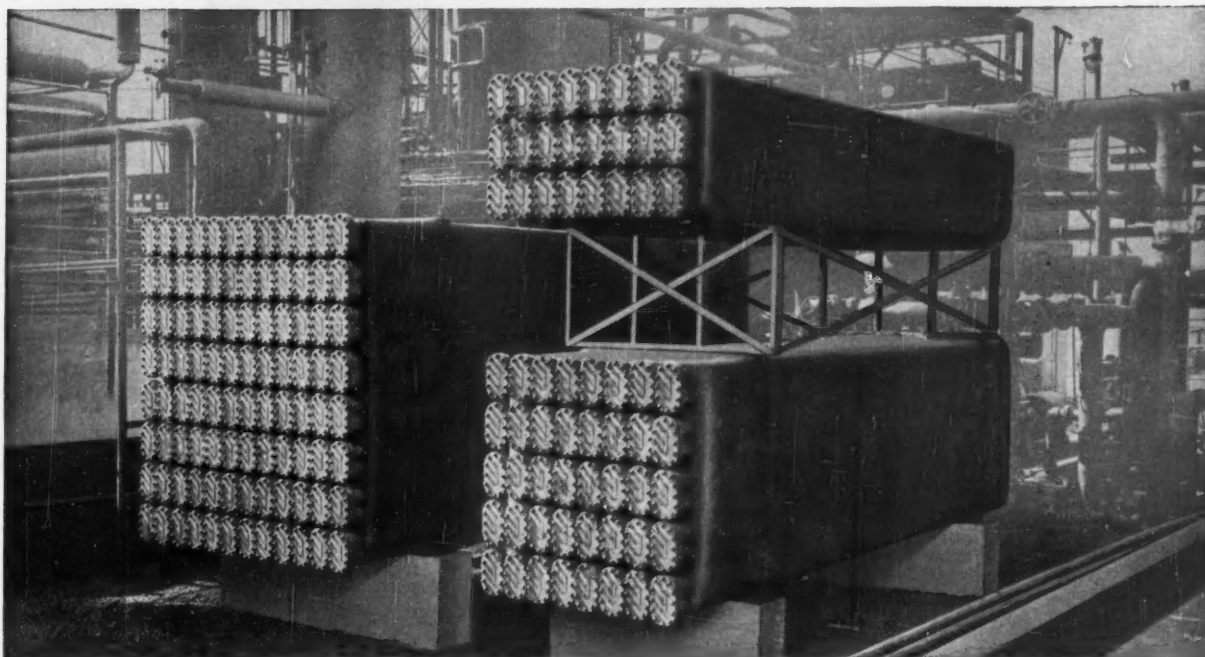


SAFETY PRODUCTS DIVISION

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Six Reasons Why you should specify



BROWN FINTUBE *Sectional* HEAT EXCHANGERS

FLEXIBILITY: If plant requirements change — and this is not uncommon — a "bank" of Brown Fintube heat exchanger sections can be disconnected and reassembled in different series-parallel arrangement easily and on short notice. "Bundle type" exchangers are not flexible. For them a change in duty usually involves designing — and waiting — for a whole new unit.

NO OBSOLESCENCE: Brown Fintube Sections never become obsolete. They can be used in one exchanger after another. Sections not in use serve as "standby" or parts, for other sections on stream.

REDUCED FOULING: Brown Fintube sections transfer more heat per lineal foot at lower surface temperatures. This minimizes coking. Also the

longitudinal passages control the material flow eliminating eddies and reducing fouling.

EASY CLEANING: reduces maintenance costs. By manifolding just one extra parallel stream into an exchanger, the entire unit can be operated continuously — always clean — without ever coming off stream.

REDUCED STORES: Avoids tying up thousands of dollars in spare parts, housing and handling them.

PROMPT DELIVERY: Standardization permits economical assembly line manufacture from standardized parts — and prompt delivery.

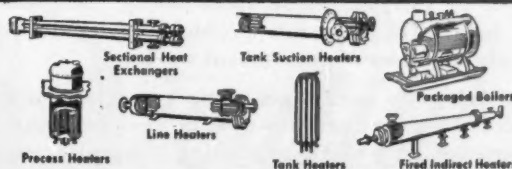
If you heat — or cool — liquids or gases in your plant, you'll get a lot of ideas from our Bulletin No. 512. Send for a copy!

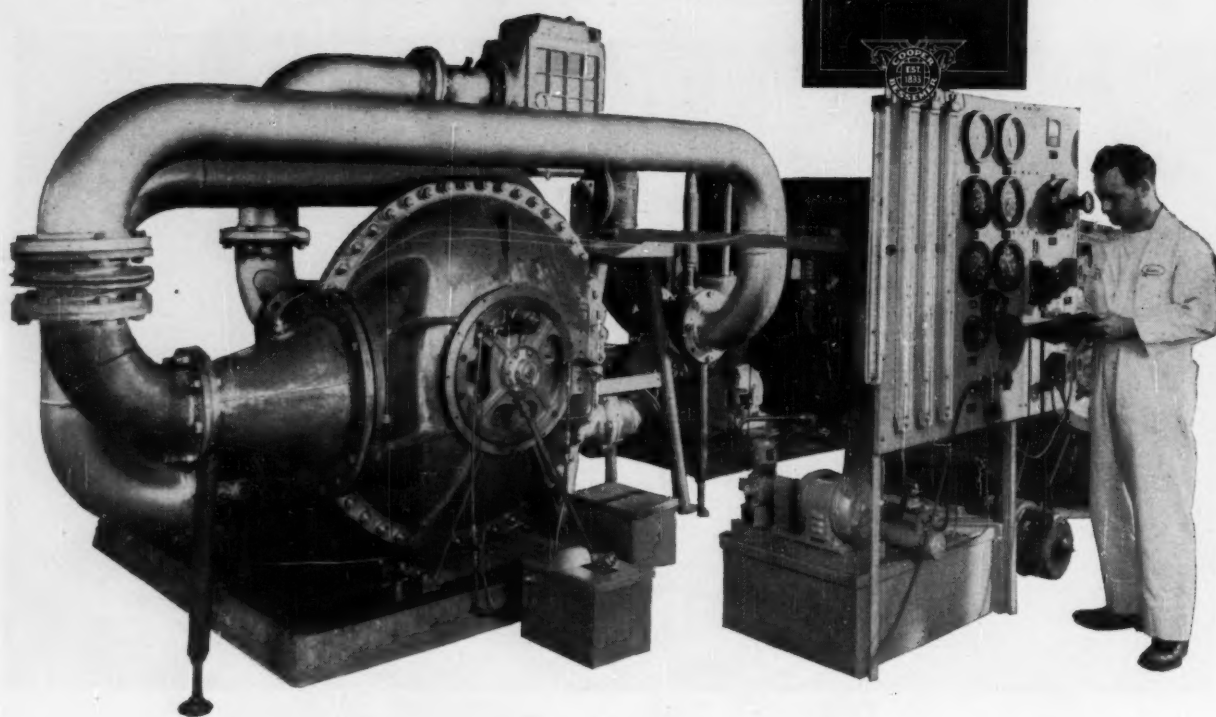


BROWN FINTUBE CO.

300 HURON ST., Elyria, Ohio

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Hot compressor...prescribed for new problems

PRAISE be, American industry is always on the go —always working out new and better ways to do things. A good example is today's incredible chemical and petrochemical industry. As in most other industries, new processing techniques have posed new problems. One is how best to handle the huge-volume compressing of gases and air. And that is a field in which Cooper-Bessemer has a 100-year stake.

Shown above during test stages is one of Cooper-Bessemer's latest answers—a highly efficient, remarkably compact, multi-stage *centrifugal* compressor, that can be driven by electric motor, internal combustion engine or turbine. These space-saving compressors will help solve many new problems of industry; are already in phases of government service.

Although such centrifugal compressors are new in application, they are not new in Cooper-Bessemer experience. Here work on rotating compressor equip-

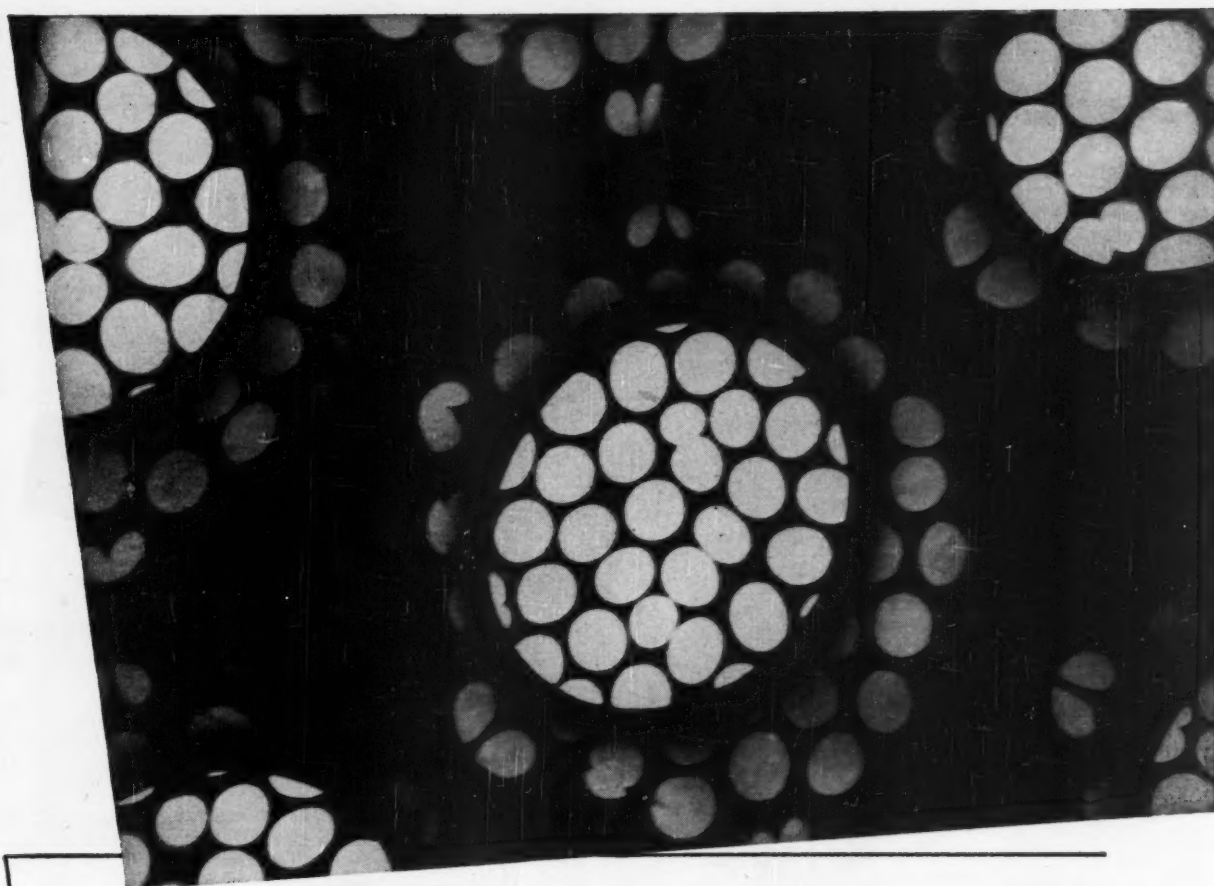
ment has been under way for years . . . anticipating these very problems . . . and the answers.

It's easy to determine whether your compressor needs can be met best, most economically with reciprocating units . . . or with new-type centrifugals. It's also easy to find out all about the *new* things being done by one of America's *oldest* engine and compressor builders . . . and it pays!



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DIESELS • GAS ENGINES • GAS-DIESELS • ENGINE-DRIVEN AND MOTOR-DRIVEN COMPRESSORS • HIGH PRESSURE LIQUID PUMPS



22,000 times as big as life

to show one why of Dicalite's
"sharp" filtration

This electron micrograph of one of the more than 10,000 kinds of diatoms shows clearly the delicate, yet rigid, "skeleton" whose lace-like grid helps make diatomite such a superior filteraid. Imagine, for a moment, millions of these diatom frustules—needle-, disc- or boat-shaped—piling up strawpile fashion in the filter pre-coat or filtercake . . . then visualize bacteria or other sub-micron sized solids (enlarged to the same scale) coming against this barrier. Now, in your mind's eye, you can see clearly how the

diatomite "grillwork" catches and holds all solids, while the fluid being filtered flows rapidly on through the billions of tiny channels which make up 90% of the filtercake's bulk.

Many processes and products in the chemical, industrial, food and pharmaceutical fields would be practically impossible without this "sharp" filtration provided by high-quality diatomaceous filter-aids such as Dicalite. These Dicalite filteraids, processed under rigid controls from the highest quality diatomite, afford a complete range of uniform, sterile, chemically-inert products for the filtration of almost any liquid. They have provided the answers to many processing problems—they could well be the answer to yours. We will be glad to furnish full information, samples adapted to your requirements, or technical engineering aid if required.

Dependable
GLC
GREAT LAKES
Dicalite[®]
DIATOMACEOUS MATERIALS

DICALITE DIVISION GREAT LAKES CARBON CORPORATION • 612 S. FLOWER ST., LOS ANGELES 17, CALIFORNIA

CHEMICAL ENGINEERING—May 1955

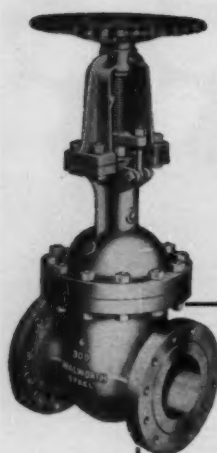
411

WALWORTH

Cast Steel Gate Valves

Series 150 and 300

Wedge Gate — Outside Screw and Yoke



Sectional view of Series 300

Big 8-Point Superiority!

Gland clearances are such that stem cannot be scored if gland should be tightened unevenly.

Deep Stuffing Boxes in all sizes (2" to 24") insure tightness and maximum packing life — costly leaks are eliminated.

Bonnets and Bodies are engineered to withstand pressure and minimize distortion — they're tough, durable, dependable.

Heavy Steel Walls provide extra strength and longer life.

Integral Body Guide Rib Faces are machined to insure accurate disc seating.

Seat Rings are bottom seated — not flange type. No recess exists at back of ring — hence no turbulence, erosion, or pressure drop.

Streamlined Ports allow high velocity, non-turbulent flow, and reduce the possibility of erosion.

Valves regularly have flanged ends. They can be supplied with ends for butt welding. Roller bearing yokes are available. On valves 5 inches and larger, by-passes can be furnished.

For Series 600 and higher, we recommend Walworth Pressure-Seal Steel Gate Valves.

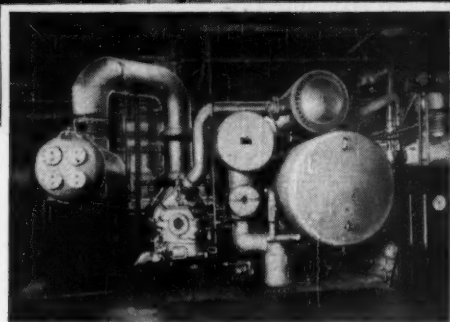
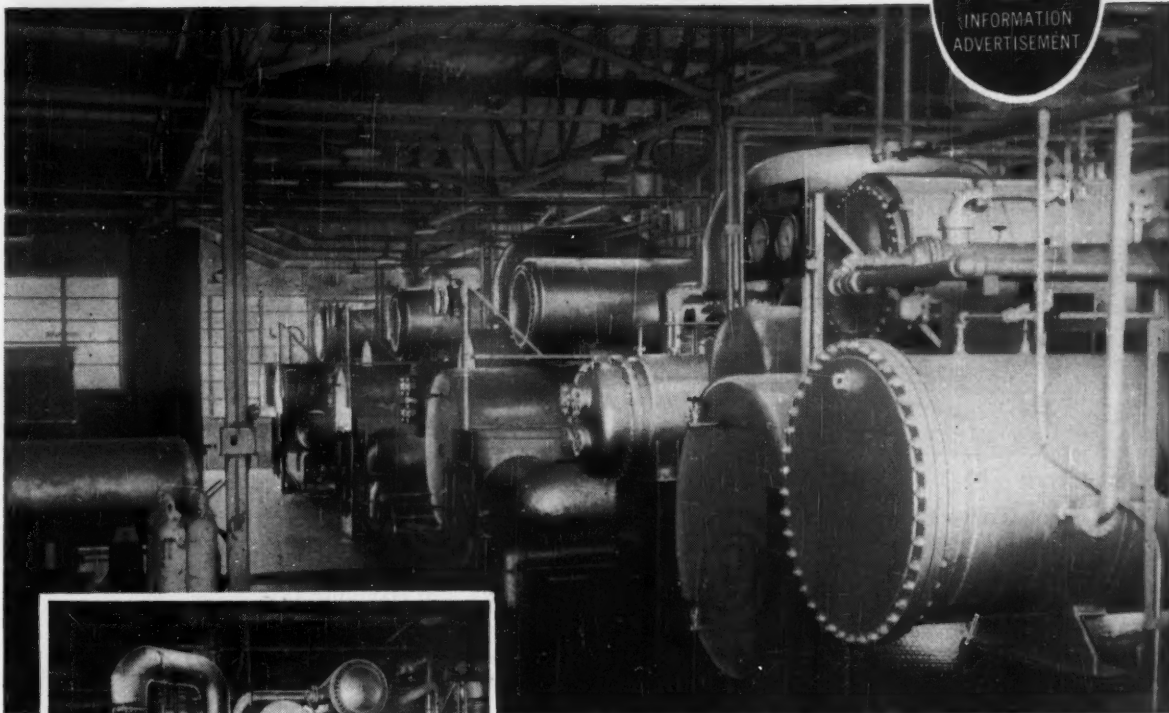
For further information on Walworth Cast Steel Gate Valves, see your local Walworth distributor, or write:

WALWORTH
valves and fittings

60 EAST 42nd STREET, NEW YORK 17, N. Y.

NEW facts for your files on York Turbo Compressors for

Chemical Plants



Four York Turbo Compressors operating on four York Turbo Brine Chilling Systems help keep production and quality at high levels for the Firestone Tire & Rubber Co., Lake Charles, Louisiana. One of these York Turbo Brine Chilling Systems is shown in greater detail in the inset at left. Each York System is capable of producing in excess of 400 TR at a leaving brine temperature of +5° F. The units are also designed to produce 230 TR at a leaving brine temperature of -35° F. Firestone uses these York Systems in the manufacture of cold GR-S rubber. The cold brine is circulated through York-designed coils in each reactor to produce the desired cooling effect.

MORE LOW-TEMPERATURE PROCESSES TODAY—and whether you need dependable, constant-capacity refrigeration on a 24-hour, seven-day-week basis, or have an application where refrigeration loads will fluctuate, York Turbo Compressors will do the job.

LOW-TEMPERATURE PROCESSES HAVE TRENDED LOWER—and York Turbo Compressors provide efficient operation in low-temperature processes down to -125° F. (using "Freon-12").

FLOOR SPACE AT A PREMIUM—and a single York Turbo Compressor may fill all your refrigeration needs. York makes Turbo Compressors, in single- and multiple-stage models, up to 3000 tons capacity with Freon refrigerants. (Models also available for

ammonia and hydrocarbon refrigeration duty and for general gas compression service.)

CHOOSE YOUR POWER SUPPLY—York Turbo Compressors may be driven by A.C. or D.C. electric motors, either constant or variable speed, steam turbines or internal combustion engines. You choose the power supply that is most economical for you.

EXTREME FLEXIBILITY—even where constant-speed drive is used, York Turbo Compressors, with their exclusive Pre-Rotation Vanes, permit efficient operation over wide ranges of capacity, using either automatic or manual control.

ENGINEERING ASSISTANCE—York's vast experience in the centrifugal compression field is part of a complete York service available to your designer.

Some Helpful Hints for Chemical Men

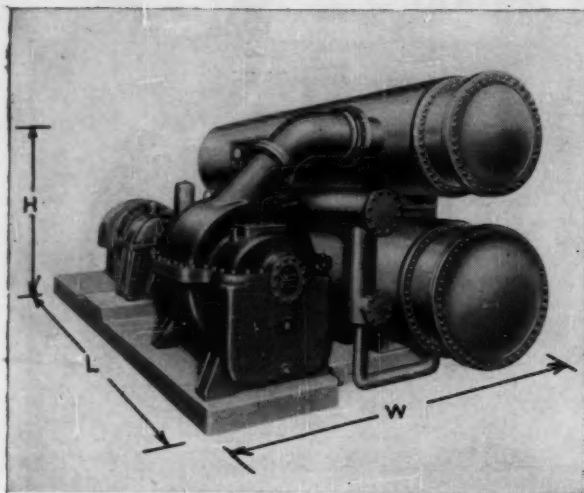
1. A temporary replacement for broken peepholes in chemical plant equipment can be made by cutting out the bottom of a Pyrex-type saucepan of blue boro-silicate glass. It can be made to fit perfectly by wet stone grinding.
2. To seal pipes against vacuum or low pressure without

shutdown, wrap a split piece of polyethylene tubing around joint, melt with blowtorch to produce seal.

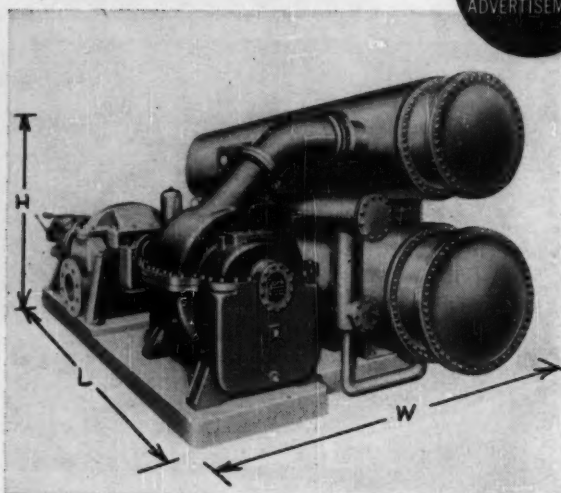
3. Install skid-proof metal plates around reaction kettle manholes to avoid damage to thermal insulation when workers must open the manholes.

CUT OUT AND FILE—SEND FOR FREE FILE FOLDER AND REPRINTS—SEE OTHER SIDE

YORK TURBO COMPRESSORS



MOTOR DRIVE



STEAM TURBINE DRIVE

York Freon Turbo Compressor Systems are particularly adapted to high-capacity refrigeration loads. Their inherent ability to handle large gas volumes permits maximum capacity per unit of floor area, while their vibration-free design permits installation in any convenient location—even on upper floors. These characteristics insure a highly compact and economical installation.

DIMENSIONS (Depending on model chosen)

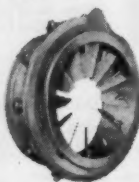
Type	"L"	"W"	"H"
Motor Drive	14'6" to 20'9"	9'9" to 15'10"	6'8" to 12'8"
Steam Turbine Drive	14'6" to 16'0"	9'9" to 15'10"	6'8" to 12'8"

NOTE: Dimension "L" will vary with type and size of motor and gear, or with type of turbine. All dimensions are based on 2- and 4-pass shells. Purge device adds 21" to overall "W" dimension.

PRINCIPAL (AND EXCLUSIVE) FEATURES



IMPELLER. Blades, hub and cover discs are made *entirely* of stainless steel—impeller blades successfully resist erosion . . . the entire wheel resists corrosion—assuring perfect wheel balance during service life. Blades are end milled to form integral rivets, eliminating heads and resulting in unobstructed gas flow and noise abatement.



PRE-ROTATION VANES for maximum capacity reduction. Capacity control is accomplished by changing direction of the rotation of suction gas entering the first stage wheel, thereby changing the characteristics of the wheel. Each change produces the same results as a separate machine of smaller size.



SIMPLIFIED REFRIGERANT SHAFT SEAL prevents gas leakage. Sealing is accomplished by two stationary carbon rings kept always in contact with the shaft seal ring. Seal surfaces are accurately finished and sealed with oil from the compressor lubricating system.



THRUST ABSORBING BALANCE DISC CUTS FRICTION LOSSES. Unbalanced shaft thrust caused by unequal gas pressure on opposite faces of each wheel equalized by balance disc. Need for a heavy duty thrust bearing with attendant higher friction losses eliminated.

York Corporation, York, Pa.



YORK CORPORATION
the quality name in refrigeration

HEADQUARTERS FOR MECHANICAL COOLING SINCE 1885

The latest advancement in

dust recovery

Dualaire*

REVERSE-JET DUST COLLECTOR!



- Cleans without jarring or rapping!
- Maintains uniformly low pressure drop!
- Field-proven efficiency as high as 99.99%!

Backed by the same organization that pioneered commercial application of COTTRELL Precipitators and MULTICLONE Collectors, the DUALAIRE Reverse-Jet Dust Collector is revolutionizing filter-type recovery systems. The DUALAIRE gives you vital advantages like these...

REVERSE-JET CLEANING ACTION

cleans the filter tube continuously in small increments—not with sudden surges as in rapping or jarring.

CLEANING ACTION starts automatically and stops automatically to keep pressure differential within low pre-set range.

FILTER EFFICIENCY remains uniformly high at all times because no thick filter cake ever forms to reduce operation

effectiveness. Actual field tests show efficiencies as high as 99.99%!

NO STANDBY UNITS, with their complicated switching devices, are needed. The DUALAIRE is cleaned as it filters—without interruptions or shut down periods for cleaning. The operation is continuous!

FILTER UNITS LAST LONGER because they are not subjected to intermittent jarring, rapping or vibration—all destructive to filter fabrics.


The above are only a few of the many important advantages you get in DUALAIRE Dust Collectors.

This 12 page booklet gives the full story... explains how reverse-jet cleaning action works — shows how the basic DUALAIRE unit is adaptable to a wide range of operating requirements — provides facts, figures and illustrations that will change your thinking on filter-type recovery systems.

Send for your free copy of this descriptive booklet — or see your nearest Western Precipitation representative!

*"Dualaire" & "Multiclone" ®

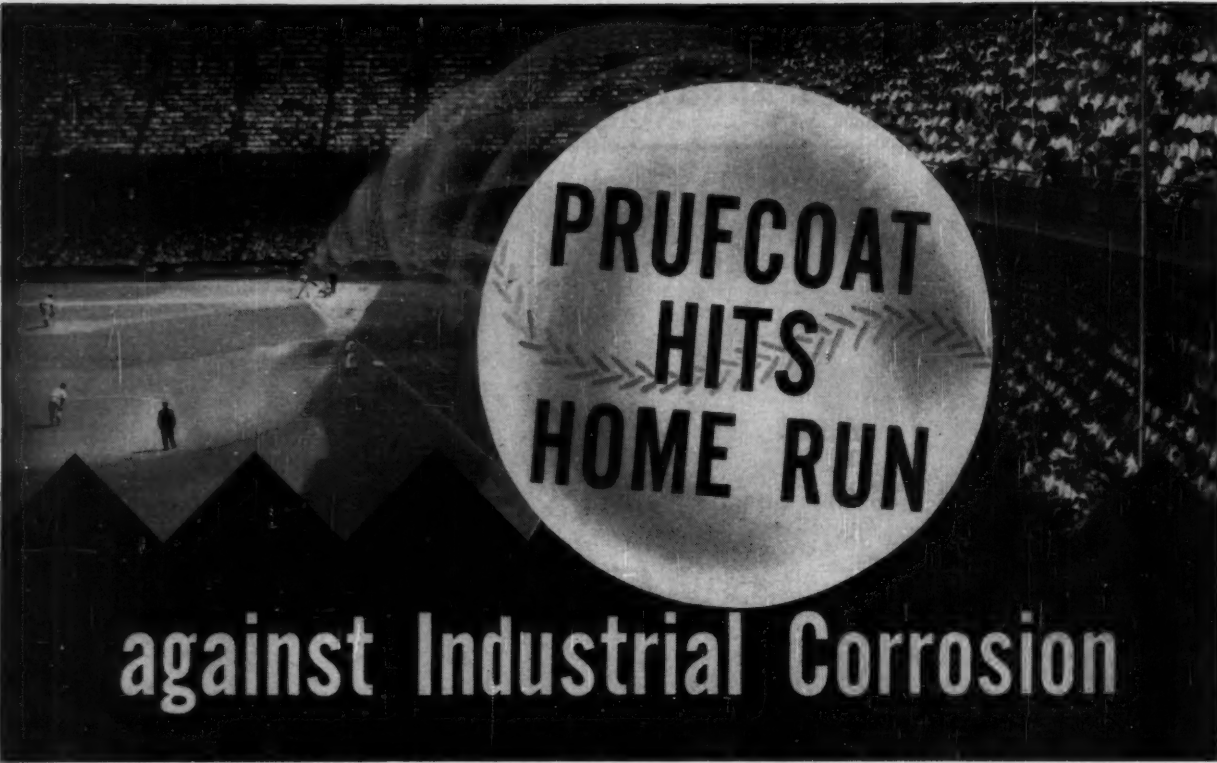
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Precipitation
CORPORATION**

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PRUF COAT HITS HOME RUN

against Industrial Corrosion

These 4 great, new Anti-Corrosion products lead the league!

1 PRUF COAT New "A" Hot-Spray Vinyl Gives Greater Mil Thickness, Improved Film Density, Better Adhesion — At Lower Cost!

Now, the performance-proven Prufcoat "A" Series Vinyl has been adapted and specifically engineered for the modern, cost-saving technique of hot-spray application. Prufcoat "A" Hot-Spray Vinyl gives you *greater mil thickness* (4-5 mils in a single spray pass), *improved film density* (no porosity or pinholing) and *better adhesion* (to primers and even to bare metal) at *lower cost* per sq. ft. of surface. With the same dry-film composition as Prufcoat "A" Series Vinyl, this hot-spray vinyl provides *controlled thickness* up to 10 mils in a cross-pass spray coat. You effect substantial labor and material cost savings.

2 New! PRUF COAT Odorless Chemical-Resistant Coatings Eliminate Odor Problems Heretofore Created by Chemical-Resistant Painting

Perfected after six years of intensive development and test, Prufcoat Odorless Chemical-Resistant Coatings provide highest resistance to acids, alkalis, and other chemicals. Scrubbable 24 hours after application, Prufcoat Odorless Coatings withstand extensive scouring and cleaning. There's no odor during application, no odor during curing of film, and no odor thereafter. Ideal for use in confined, poorly ventilated areas. Suitable for application over wood, metal, or concrete. No wrinkling or lifting of old paints. Easy to apply, and supplied in a variety of colors. Effects substantial savings by eliminating shut down time and other costly annoyances.

3 PRUF COAT New Fast-Dry Primer P-50 Lets You Over-Coat In Just Two Hours!

The famous Prufcoat Primer P-50, proven best by five years of tested-in-use applications, now with new

fast-dry action. All the unequalled advantages of the finest universal metal primer on the market, *plus 2-hour drying time!* You do your complete coating job from primer to top coat in *just one day*. This heavy bodied, rust inhibitive oleoresinous metal primer insures 2 mils or more thickness in the prime coat alone. Prufcoat Fast-Dry Primer P-50 provides positive primer-to-surface and top coat-to-primer adhesion. Only wire-brush and scrape surface preparation is needed, and yet Prufcoat Fast-Dry Primer P-50 absolutely controls underfilm corrosion and rust creepage.

4 PRUF COAT "Gloss" Mastic The Perfected Vinyl Base Mastic With Exclusive "Gloss" Finish That Substantially Improves Chemical Resistance, Gives Measurably Better Appearance

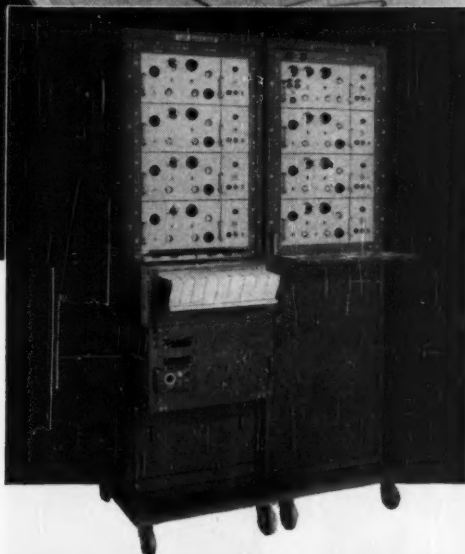
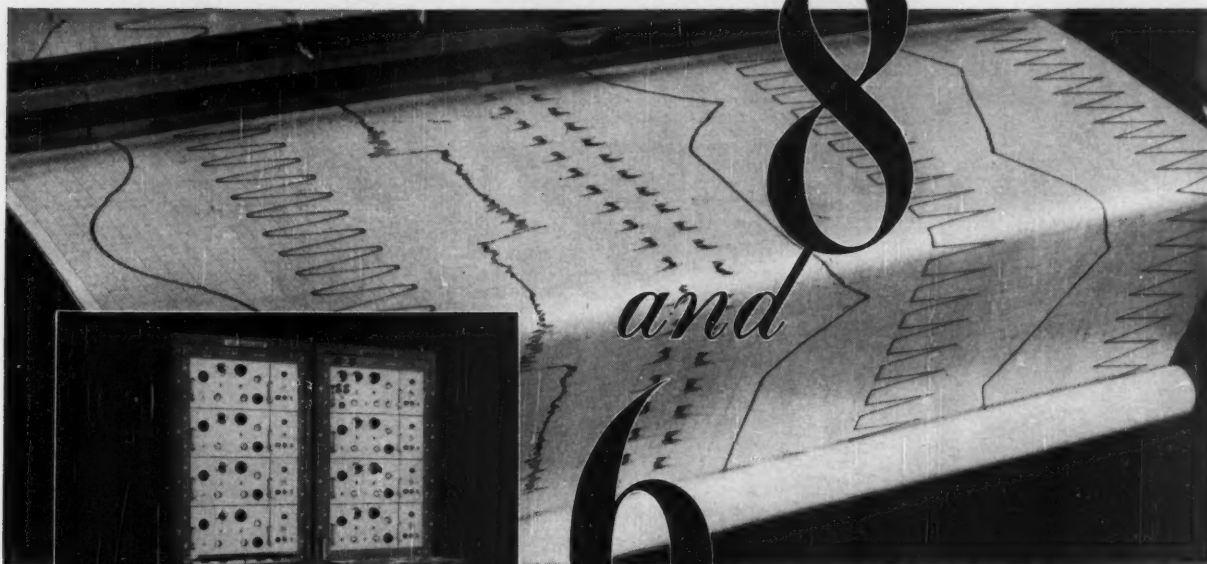
This exclusive mastic formulation, based on vinyl and other chemical-resistant resins, gives exceptionally heavy build in cross-coat spray application, using conventional cold spray equipment. Flexible, heavy bodied, with a high solids content, Prufcoat "Gloss" Mastic provides a tough and substantial coating over rough and hard-to-protect structural or machine areas including rivets, welds, angles, and edges. This high build, combined with the proven chemical resistance of vinyls makes Prufcoat "Gloss" Mastic an important new corrosion-control tool.

You score with this big league Prufcoat team on your side. It covers the field and bats 1,000 this season with products engineered and test-proven to solve the toughest corrosion problems. Get these Prufcoat winners going to bat for you in your fight against corrosion by writing today for complete information on properties, benefits, costs, specifications, and application techniques of these four major new product developments. No obligation, of course.

PRUF COAT LABORATORIES INCORPORATED

Sales Office: 50 E. 42nd Street, New York 17, N. Y. Plant: 63 Main Street, Cambridge 42, Mass.

now SANBORN



CHANNEL "150" SERIES OSCILLOGRAPHIC RECORDING SYSTEMS

in
addition to



and



Channel
Models

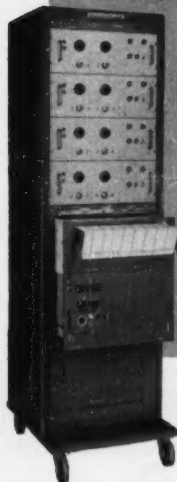
These new additions to the "150 family" follow the original "150" design concept which permits rapid change-over from one set of recording requirements to another by means of interchangeable, plug-in type preamplifiers.

The Model 158-5460 eight-channel system (upper left photo) consists of an eight channel recorder assembly and eight Driver Amplifier-Power Supply units. To this basic assembly the user adds any combination of Sanborn "150" plug-in preamplifiers to meet his requirements. Each channel provides a 4 cm deflection.

The six-channel system (156-5460) has the same basic assembly, except for *two less* galvanometers and *one less* Driver Amplifier-Power Supply unit in each cabinet. Each channel provides a 5 cm deflection.

Both systems offer: *nine* chart speeds (0.25 to 100 mm/sec.); *extended* frequency response; *improved* regulated power supplies; *individual* stylus temperature control for each channel; *improved* control of input signals by 1, 2, 5, 10, 20, etc. attenuator ratios; controls for timing, manual and remote coding.

Also 8 and 6 Channel Systems for recording analog computer outputs,



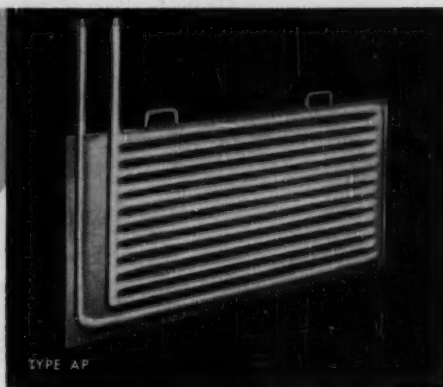
or other applications where 1 volt/cm sensitivity is usable. complete eight-channel system shown comprises four Model 150-2000 Dual Channel DC Amplifiers and an eight-channel Recorder Assembly. Each Dual-Channel Amplifier is complete with common power supply. (The six-channel version is identical, except for *two less* galvanometers and *one less* Dual-Channel Amplifier.) Also four channel models.

Write for catalog material on any
Sanborn "150" Recording System

SANBORN  **COMPANY**
CAMBRIDGE 39, MASS.

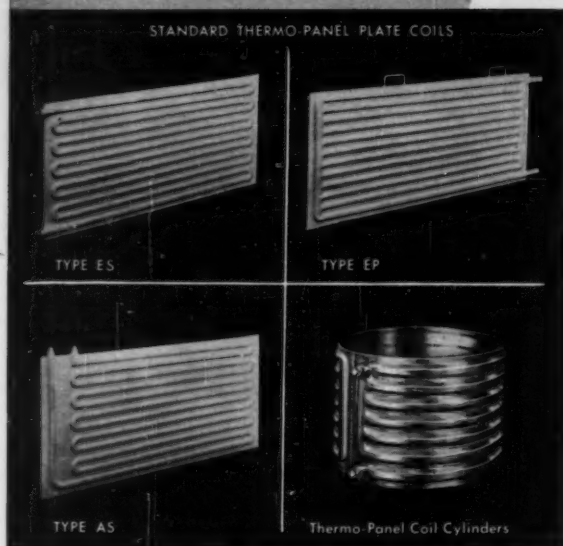
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on pipe coil

more efficient
more economical
more convenient



MORE
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AREA
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PIPE
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ITS SIZE

DEAN THERMO-PANEL[®] PLATE COIL



Embossing patterns at variance from the four types described are available. Consult our Engineering Department with your problem.

THERMO-PANELS

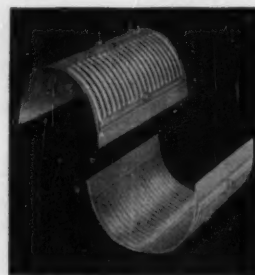
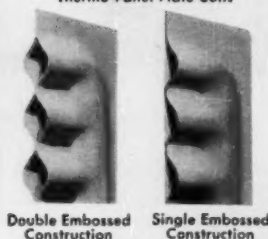
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Waxes, Acids, Alkalies, Electrolytes
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They are also suitable as radiant heat screens around
furnaces, hearths, ovens, cool-off chambers, atmosphere
controlled ovens, forge presses, die-casting and injection
molding machines, etc.

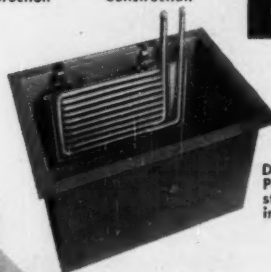
FASTER HEAT TRANSFER AT LESS COST

You save space and heat or cool more efficiently . . . for these scientifically designed units for which performance can be accurately anticipated are an economical replacement for pipe coils. You save almost 50% on initial cost as compared with pipe coils. You save on maintenance because they are easier to clean and can be removed from tanks without dumping the solution.

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THERMO-PANEL

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DEAN PRODUCTS, INC. • 616 Franklin Ave., Brooklyn 38, N. Y.
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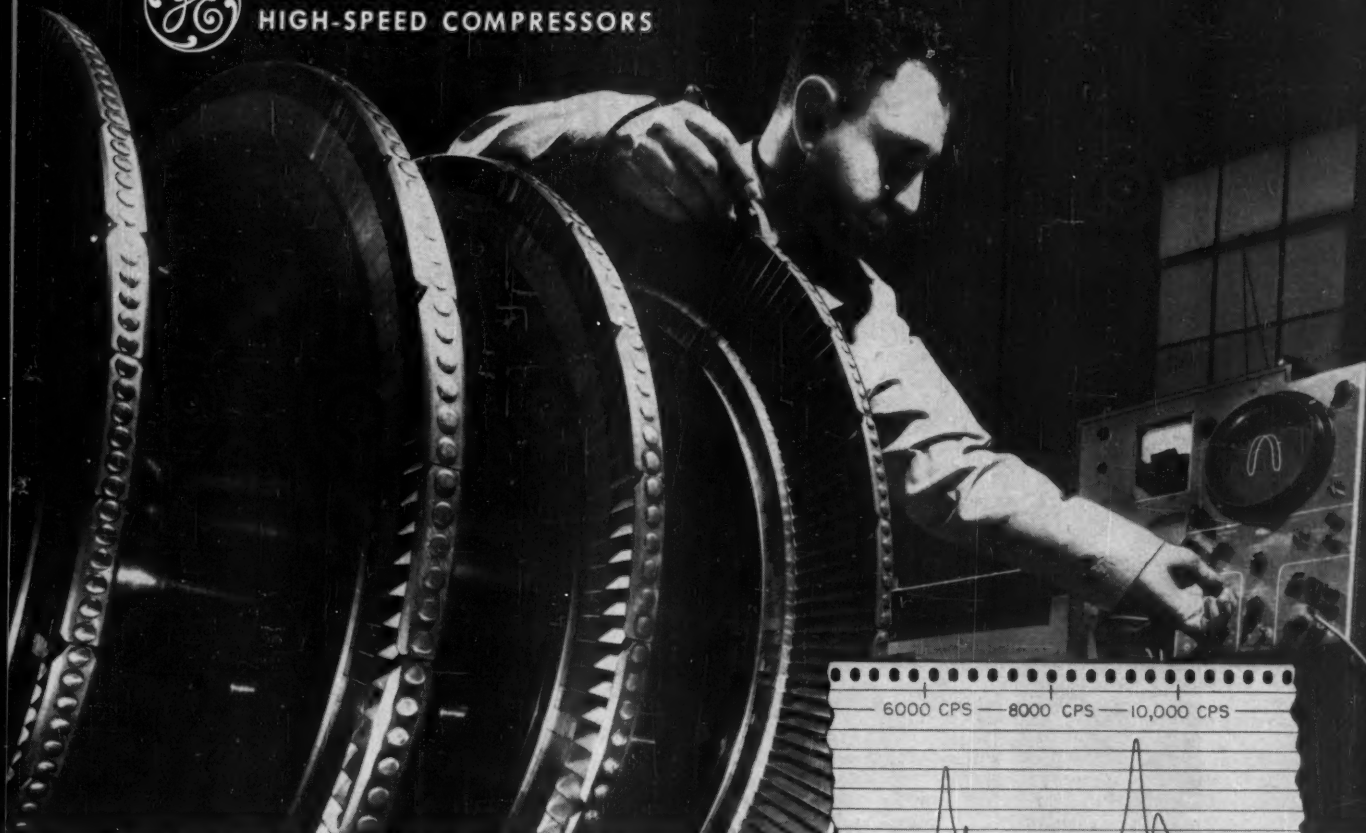
Available in special shapes such as "U"s, "L"s, and cylinders . . . and in a wide range of materials, including lead-coated iron, stainless steel, monel and other special alloys.

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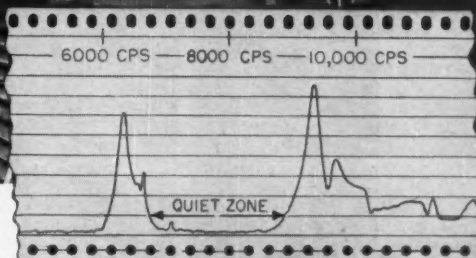
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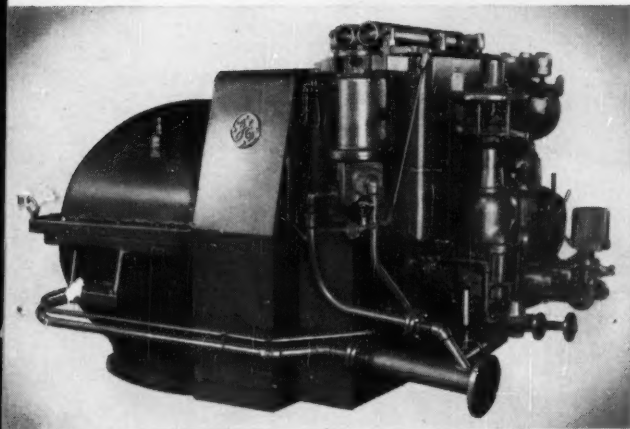
**TURBINES FOR
HIGH-SPEED COMPRESSORS**



VIBRATION RECORD, inset, is obtained by exciting buckets. Peaks indicate resonant vibration response of buckets. For more reliable operation, G-E engineers confine bucket exciting frequencies to "quiet zones" between the peaks.



How G-E Engineers Locate "Quiet Zones" for Safer High-speed Turbine Operation



TYPE DRV HIGH-SPEED MECHANICAL-DRIVE TURBINE

When driving modern compressors and blowers, G-E high-speed turbines spin at operating speeds of 7000 rpm and up. At such speeds, if resonant vibration were not controlled carefully, bucket fatigue failure might result.

HERE'S HOW General Electric combats the problem: Natural vibration frequencies of the buckets on each new turbine rotor are determined with the special equipment shown above—an oscillator, crystal pick-up, and high-speed level recorder. "Quiet zones" of minimum normal vibration are clearly revealed.

With this information available, the number of nozzles can be varied so that steam striking the buckets will create vibration-exciting frequencies only in these "quiet zones." By thus making sure that steam-impact frequencies don't coincide with critical natural frequencies, the chance of bucket failure is greatly reduced.

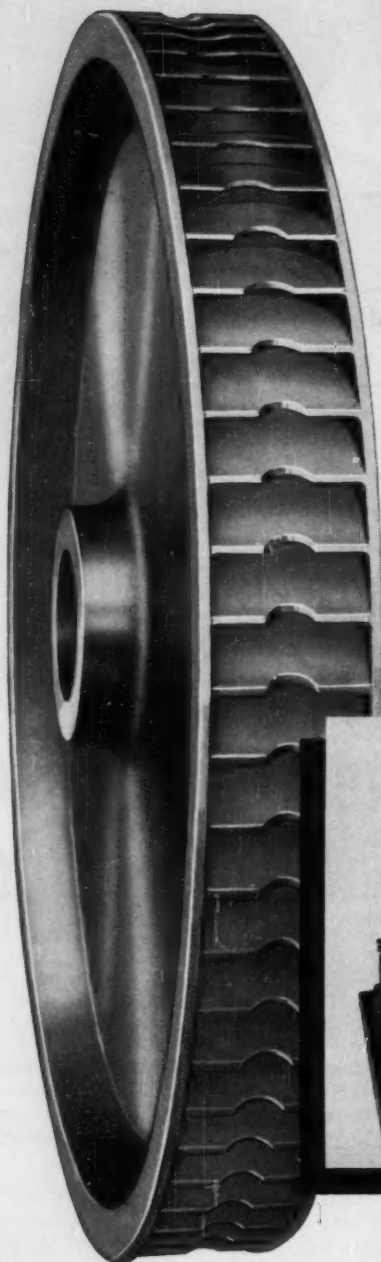
VIBRATION TESTING is one of many features that add to the reliability of G-E high-speed turbines. For more information, contact your nearest G-E Apparatus Sales Office or write General Electric Company, Schenectady 5, N. Y.

241-2

Progress Is Our Most Important Product

GENERAL  ELECTRIC

TERRY SOLID-WHEEL *SIMPLICITY* MEANS SUSTAINED HP



A Terry solid-wheel turbine is simplicity itself. Particularly the rotor. This is a single forging of special composition steel. And, unlike a built-up wheel, has no separate parts to loosen or work out.

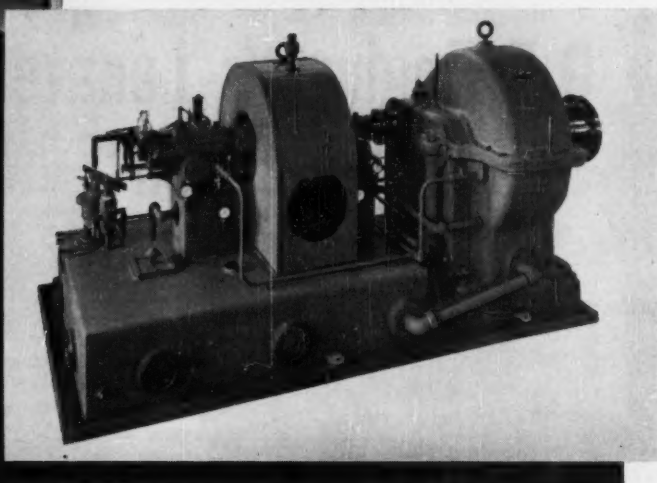
Blade wear which might occur after years and years of usage is of little consequence, because the power-producing action of the steam takes place on the curved surfaces at the backs of the buckets. Thus wear does not materially affect horsepower or efficiency.

The blades can't foul. There is a one inch clearance on either side of the wheel and, in addition, the blades are double rim protected. There is no need for close axial blade clearance, because the steam enters the buckets at right angles to the shaft.

Perhaps you, too, can profit from Terry solid-wheel stamina. Bulletin S-116 gives complete details. Send for a copy today.

TERRY STEAM TURBINE COMPANY

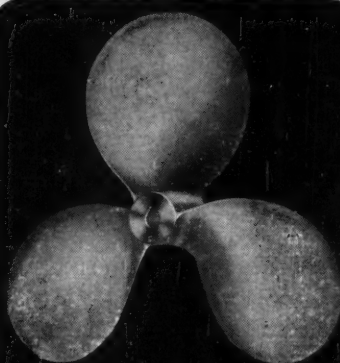
TERRY SQUARE, HARTFORD 1, CONNECTICUT



This Terry solid-wheel turbo-gear unit is rated 600 hp, 4000/650 rpm for 820 psi, 825°F steam with 275 psi back pressure.

TERRY

TT-1201



**industrial
propellers**

for { MIXING
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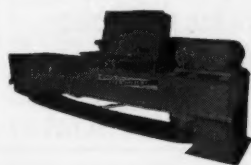
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the Process Industry



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COMPLETE SYSTEMS ENGINEERED AND PRODUCED

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WITH AUTOMATIC, SHOCKPROOF THAYER-PLATE SCALES.
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DISPLAY ADVERTISING

• Arouses Interest

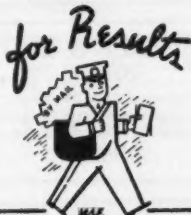
• Creates Preference

DIRECT MAIL

• Gets Personal Attention

• Triggers Action

After your prospect has been convinced by
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ful action-getter. Send for our Industrial
Direct Mail Catalogue, 150 lists available.



Mc GRAW-HILL
DIRECT MAIL LIST SERVICE

Direct Mail Division,
McGraw-Hill Publishing Co., Inc.
330 West 42 St., N. Y. 36, N. Y.

Please forward my free copy of the McGraw-
Hill "Industrial Direct Mail Catalogue."

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Company _____

Address _____

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NEW SERVICE
AND

A PROCESS

FOR MAKING

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WAFERS**

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OVER FLAKES
OR OTHER SHAPES

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PROFESSIONAL SERVICES

PROCESS DEVELOPMENT & PILOT PLANT WORK
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CATALYST DEVELOPMENT
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CHEMICAL & BACTERIOLOGICAL ANALYSIS
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Consultation — Design
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CONSULTING CHEMICAL ENGINEER
Evaporation, crystallization, and Heat Transfer;
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Chemical & Industrial Engineers
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MU. 6-4712

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Chemical and Electrochemical Plants
Complete Process and Project Engineering
Research Guidance Economic Surveys
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Engineers and Constructors
Reports and Surveys
New York, New York

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Plant Design & Surveys covering Chemicals, Elec-
trochemical and Metallurgical Production; Trade
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Consulting Chemical Engineer

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Economic - SURVEYS - Technical
Process DEVELOPMENT - Product
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CHEMICAL AND INDUSTRIAL PLANTS
PROCESS STUDIES — PATENT REPORTS
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KOHN & PECHENICK

Consulting Chemical Engineers

Plants — Process — Equipment
DESIGN
Reports Trouble-Shooting Appraisals
262 Huron St. Brooklyn 22, N. Y.

JAMES P. O'DONNELL

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CHEMICAL AND PETROLEUM PROCESS
PLANTS
Design—Procurement—Construction Supervision
Start-Up
New York, N. Y. Beaumont, Texas

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Design - Construction - Reports - Appraisals
80 Broad Street, New York 4

Knowledge plus Experience . . . always a vital asset—

When you are in need of expert advice to be applied to solving your particular problems, save
TIME and COST by calling in a specialist.

These consultants have broad experience in management services that can be invaluable to you.

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EMPLOYMENT • BUSINESS •

OPPORTUNITIES

EQUIPMENT—USED or RESALE

UNDISPLAYED RATE:

\$1.50 a line, minimum 3 lines. To figure advance payment count 5 average words as a line.

POSITION WANTED undisplayed advertising rate is 1/2 of above rate, payable in advance.

PROPOSALS, \$1.50 a line an insertion.

BOX NUMBERS count as one line additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED RATE:

The advertising rate is \$14.75 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured 7/8 inch vertically on one column, 3 columns—30 inches—to a page.

EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

EMPLOYMENT ADVERTISING

New Employment Opportunities Section for Displayed ads starting July issue. For further details see announcement ad in this section.

Send **NEW ADVERTISEMENTS** to N. Y. Office, 330 W 42nd St., N. Y., 36, N. Y. for June issue closing May 5th

CHEMICAL ENGINEERS

Excellent opportunities open to men who are qualified for Process Development, Production and/or Engineering Design fields. The work is related to the expanding operations of a long established mid-western chemical company and will provide opportunities at most levels of experience.

Applicants must be eligible for security clearance by AEC, and should submit complete resume of personal data, education, previous experience, salary desired and references. All replies will be treated in confidence.

P-5551, Chemical Engineering
520 No. Michigan Ave., Chicago 11, Ill.

SANITARY ENGINEER

Opportunity available for Sanitary Engineer in an expanding pulp and paper mill located in the Middle Atlantic States. Age 25-35 years. Require man experienced in Paper Mill waste, Paper Mill stream pollution and Paper Mill water purification. No other experience will be given consideration. Good salary and advancement. Send resume of educational background and industrial experiences. All replies confidential.

P-5552, Chemical Engineering
330 W. 42 St., New York 36, N. Y.

MECHANICAL ENGINEER with several years experience in actual supervision of large shops comprising machine shops, plate and welding shops, iron, steel and brass foundries.

DESIGN DRAFTSMAN for Mechanical Department's Engineering Office.

ASSISTANT MINE FOREMAN—graduate mine engineer.

MINE LEVEL BOSS—graduate mine engineer.

ASSISTANT GENERAL SMELTER FOREMAN with good suitable education and all around smelter operating experience. Should have executive ability and be able to assume responsibility.

TRAINMASTER to coordinate all sections of Operating Division, including supervision of train crews, dispatchers, yard and station forces, car distribution, etc.

MAINTENANCE ENGINEER (OR MILL MASTER MECHANIC)—graduate Mechanical Engineer to take charge of all mechanical maintenance and repairs for all equipment throughout Concentrator Plant and operations. Should have good understanding of metallurgical processes and equipment.

Large Copper Company Chile, South America. 3-year contract. Transportation both ways and salary while traveling paid by Company. Good opportunities. In reply give complete details.

P-6064, Chemical Engineering
330 W. 42 St., New York 36, N. Y.

TAPE RESISTOR SPECIALISTS

Openings at junior and supervisory engineering levels for men qualified to conduct advanced research and development work in the tape resistor field beyond the present state of art for printed circuit applications. Mid-west location. Salary open. Will assume moving expense. Inquiries held in confidence. Send complete background information to: Box No.

P-5755 Chemical Engineering
520 N. Michigan Ave., Chicago 11, Ill.

WANTED**TECHNICAL EDITORS**

To provide for its continued growth Chemical Week is seeking two additional assistant editors—preferably chemists or chemical engineers with two to three years business experience. Essential: Ability to meet people, dig out facts, interpret them intelligently and write lucidly. Please submit resume to:

Personnel Director
McGraw-Hill Publishing Co.
330 W. 42nd St.
New York 36, N. Y.

PROJECT ENGINEER

Wanted Mechanical or Chemical Engineer with minimum of five years' experience to handle projects covering changes and additions to plant processes, buildings, machinery and equipment for large corn and soybean processing plant.

Permanent position with established company located in town of 70,000. Retirement and other company benefits. Please send complete resume to Personnel Department.

A. E. STALEY MFG. CO.
Decatur, Ill.

CHEMICAL ENGINEERS

*Experienced In
Technical Sales*

Have several attractive openings for men with selling experience in continuous filtration or allied fields. Excellent opportunity for qualified man to act as district representative and other similar opportunities at several locations. Send full details to:

Filtration Engineers, Inc.
155 Oraton Street
Newark 4, New Jersey

DESIGNERS

*Career Opportunities
with an
Expanding Company*
Procter & Gamble

As a result of an increase in its long-term program, Procter & Gamble is seeking a number of designers for its Engineering staff in Cincinnati.

Needed: Designers experienced in any of the following: Automatic packaging machinery, piping, plant layout, and process equipment.

Salary commensurate with experience

Procter & Gamble—a leading manufacturer of synthetic detergents, soaps, shortening, and other chemical products—has been selected by the American Institute of Management for the last five years as one of the 12 best managed companies in this country.

Send letter stating education, experience, military status, and salary requirements to:

Mr. R. Trent
Dept. A
M. A. & R. Building
The Procter & Gamble Co.
Cincinnati 17, Ohio

All replies held in confidence

Procter & Gamble**UTILITIES ENGINEER
(Foreign Service)**

Chemical Engineer with minimum 5 years' experience in operational & maintenance phases of steam electric power plants.

Write giving full particulars regarding personal history and work experience. Please include telephone number.

Recruiting Supervisor, Box 46

**ARABIAN AMERICAN
OIL COMPANY**
505 PARK AVENUE
NEW YORK 22, NEW YORK

EXCEPTIONAL OPPORTUNITY FOR PROCESS DESIGN ENGINEERS

Large eastern chemical industrial concern has openings for process design engineers with B.S. or M.S. degree in chemical, electrical, or mechanical engineering. Responsibilities will involve sufficient knowledge to translate pilot plant and process development information into full scale plant design. Electrical engineers with rectifier experience helpful. Prefer five years industrial experience. Excellent facilities, salary and opportunity above average.

Your reply will be held confidential. Include age, education, experience, and salary requirement. Our employees know of this ad. Reply to

P-5898, Chemical Engineering
330 W. 42 St., New York 36, N. Y.

PRINTED COMPONENTS SPECIALIST

A mid-western electronic company has an excellent opportunity for an engineer possessing a comprehensive background in the printed circuit component field.

The technical requirements for this position include:

1. Extensive general knowledge of currently used printed circuit manufacturing processes.
2. Extensive detailed knowledge of tape resistor and deposited film resistor manufacturing processes. Ability to conduct advanced research and development in this field.
3. Extensive detailed knowledge of currently used printed circuit capacitor manufacturing processes. Ability to conduct advanced research and development in this field.

Salary open. Will pay moving expense. Inquiries treated confidentially.

P-5753, Chemical Engineering
520 N. Michigan Ave., Chicago 11, Ill.

MANUFACTURER'S REPRESENTATIVES WANTED

Polyethylene fittings and closures for glass, metal and polyethylene containers such as snap caps, dispensing caps and plugs—liners and other allied products. Top quality and standards. Complete development and engineering facilities. Forward information including territory, firms and lines handled to

RW-6082, Chemical Engineering
330 W. 42 St., New York 36, N. Y.

POSITION AVAILABLE

Editorial and Writing for the Monthly Publication of a National Technical Society in the Southwest. 25 to 35 years, with technical training.

CHEMICAL FIELD PREFERRED
P-5909, Chemical Engineering
520 N. Michigan Ave., Chicago 11, Ill.

ASSISTANT to PRESIDENT!

Chicago suburb filter manufacturer offers excellent opportunity for young man with chemical, metallurgy or filtration background to step in at executive level. Will work as direct assistant to President on sales, lab. and design. State age, experience and salary.

R-6152, Chemical Engineering
520 No. Michigan Ave., Chicago 11, Ill.

CHEMISTS & CHEMICAL ENGINEERS

Experienced in calendared vinyl film and sheeting. Must be familiar with formulation and quality control. Permanent position, opportunity for advancement, excellent salary.

P-6176, Chemical Engineering
330 W. 42 St., New York 3, N. Y.

ENGINEERS—ADMINISTRATORS —SALESMEN—EMPLOYERS

Confidential, rapid and professional service for nation wide placement in the Chemical field. Write giving age, education and brief experience. Employers send us job description. We will let you know how we can help you by return mail.

Grashner's Chemical Exchange
"The Nation's Largest"
116 South Michigan Chicago 3, Illinois

CHEMICAL ENGINEERS

An active, confidential service!
Interview at your convenience.

Call, write or wire

GLADYS HUNTING (Consultant)
DRAKE PERSONNEL, INC.
7 W. Madison St. Chicago 2, Ill.

CHEMISTS—CHEMICAL ENGINEERS

B.S. to Ph.D. Beginners—Experienced

We place EXCLUSIVELY with

Chemical Companies

Call—Come In—Send 5 résumés

SELECTIVE PLACEMENT

EMPLOYMENT AGENCY

17 William Street Newark, N. J.

C. A. Reed Jr., M.Sc. S. Goodman, M.Sc.

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 66 Post St. (4)

POSITIONS VACANT

Wanted: Graduate Engineers, preferably chemical for both headquarters consulting and field sales work. For sales, should have 3 or more years successful record. For consulting, young men preferred so that our business can be taught to them and then can move up in subsequent years. Write P-5460, Chemical Engineering.

Chemical Engineer to head chemical engineering dept. of young four year state college. Doctorate essential. Salary for twelve months open. Address Dean Lamar State College, Beaumont, Tex.

Wanted: Ambitious Chief Engineer for large eastern custom molder. Imagination, and initiative—experienced in plastic mold design, secondary tool design—knowledge of various molding materials and estimating. Excellent opportunity to work with top management in developing new outlets for plastics. Send complete resume with past salaries and desired salary, also photograph if available. Must be willing to relocate. For the right man a wonderful opportunity is available. P-5937, Chemical Engineering.

SELLING OPPORTUNITIES OFFERED

Manufacturer of heat exchangers and pressure vessels, located in New Jersey, wants sales representatives in various parts of country. Representatives should have contacts in oil refineries, power plants, chemical plants, or marine. RW-5581, Chemical Engineering.

Manufacturer's Sales Representative. Standard line Supreme crushers, for wax, rosin, resins and miscellaneous chemicals. F. P. Miller & Son, Inc., 36 Meadow Street, East Orange, N. J.

EMPLOYMENT SERVICES

Salaried Positions \$5,000 to \$35,000. We offer the original personal employment service (established 45 years). Procedure of highest ethical standards is individualized to your personal requirements. Identity covered, present position protected. Ask for particulars. R. W. Bixby, Inc., 653 Brisbane Bldg., Buffalo 3, N. Y.

Salaried Personnel, \$3,000-\$25,000. This confidential service, established 1827, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. P, 241 Orange St., New Haven, Conn.

POSITION WANTED

Mechanical Engineer—32, Registered. Keen interest in research dealing with company wide procedures and problems. Technically sound, imaginative, and thoroughly familiar with both mechanical and chemical fields. A good engineer who desires to broaden his outlook. FW-6159, Chemical Engineering.

Project Engineer—BSME—PE—18 years experience in project, plant, and design engineering in organics, inorganics, pharmaceuticals, and plastics. Any location considered. PW-6182, Chemical Engineering.

EXCLUSIVE TERRITORIES AVAILABLE

For firms or individuals to sell and service leading manufacturers complete line of

Corrosion Proof Materials
and Construction

On Commission Basis. Locations Available: Alabama, Carolinas, Georgia, Kentucky, Minnesota, Missouri, Virginia, Kansas.

RW-4227, Chemical Engineering
520 N. Michigan Ave., Chicago 11, Ill.

MANUFACTURERS' REPRESENTATIVE

Territories available for revolutionary mixers with basic U. S. patent. Recent German design with proven performance for multi-purpose operation. Laboratory models and production models ranging through 6,000 gallons total capacity. Mixes powders, granulates, solids, fibers and liquids normally difficult to accomplish. Write full details of services and territory to

RW-6042, Chemical Engineering
330 W. 42 St., New York 36, N. Y.

EXCLUSIVE TERRITORIES

Available for aggressive sales organizations to sell processing equipment for 120 year old manufacturer

SW-5595, Chemical Engineering
520 N. Michigan Ave., Chicago 11, Ill.

Attention... EMPLOYMENT ADVERTISERS!

Effective with the July issue, a new section will start in CHEMICAL ENGINEERING. We will head this section: EMPLOYMENT OPPORTUNITIES. All Displayed Employment Opportunity advertising will be placed in this new section, with the exception of those advertisers who contract for run-of-book position. Advertising in the EMPLOYMENT OPPORTUNITIES section will be billed at the new open rate of \$19.50 per inch. Contract rates furnished on request. Ads are subject to Agency Commission.

For full information write:

CHEMICAL ENGINEERING
330 West 42nd Street,
New York 36, N. Y.

LIQUIDATING FROM CLOSED PLANTS

- 1—Traylor Rotary Kiln 10'6" dia. x 105' long, welded shell 3/4"
- 1—Penn. Ring Type Granulator, Trojan K3-24, 40 HP
- 1—Allis Chalmers 6' dia. x 16' long steel lined continuous Ball Mill
- 3—Patterson & Abbe 4'6" dia. x 12 cont. Pebble Mills
- 2—Charlotte Colloid Mills, model #50, 75 HP motor
- 1—Bird solid bowl Centrifuge 36" x 50"
- 3—Muffle Furnace chrome nickle alloy tubes 24" x 8'6" long
- 3—Rotocloner Type W, size 20, Exhausters and Dust Collectors
- 1—Nash Hytor Compressor with 20 HP motor, Bronze
- 1—Ing. Rand type 20 Air Compressor, 30 HP
- 1—Cleaver Brooks Package Boiler, 350 HP, 125# W.P.
- 1—Coppus 75 HP Turbine Drive
- 2—Stainless Clad Tanks, 2000 and 6500 gal.

JUST PURCHASED ACETIC ANHYDRIDE FACILITIES

(Built in 1946-47)

- 1—Lummus Co. Acetone Cracking Heater
- 4—Copper Bubble Cap Distillation and Absorption Columns:
 - (1) 66" dia. x 27 plates
 - (1) 48" dia. x 40 plates
 - (1) 60"-48" dia. x 27 plates
 - (1) 48"-30" dia. x 44 plates
- 22—Ross and Patterson Shell and Tube Condensers and Heat Exchangers, pressure units, from 69 sq. ft. to 1320 sq. ft. sizes copper tubes.
- 2—Type 316 Stainless Steel Tanks, 5/16" thick, dished heads, heat treated and water quenched:
 - (1) 4200 gal. 6' dia. x 20' long
 - (1) 1000 gal. 4' dia. x 10' long
- 25—Taber and Ing-Rand Bronze Centrifugal Pumps, with motors.
- Lot Copper and Brass Piping, tubing, fittings, etc.

Equipment
Bought & Sold

Plants
Liquidated



PERRY

EQUIPMENT CORP.

1413 N. 6TH ST., PHILADELPHIA 22, PA.

IN STOCK

- 1—Blaw Knox 15 gal. Pilot Plant or Resin Kettle, T347 St. St. Agit. & Jktd. 150# pr.
- 2—Blaw Knox 1/2 gal. St. St. Autoclaves, 200# pr., Agit.
- 1—2600 gal. T347 St. St. Jktd. Vacuum Kettle
- 1—Fitzpatrick Model F, Comminuting Mach., 25 HP
- 1—Conkey Triple Effect Evaporator, Herculo, total 1900 sq. ft.
- 1—500 gal. St. St. Evaporator, 145 sq. ft. heating coil.
- 15—Distillation, Solvent Recovery and Absorption Columns — 8" to 72" dia. — Aluminum, Copper, Steel, Stainless Steel
- 1—Sharples 16P St. St. Centrifuge
- 1—A.T.&M. 48" Susp. Centrifugal, Perf., St. St. Fume Tight
- 1—Stokes 3' dia. x 15' L Jacketed Rotary Vacuum Dryer
- 1—8800 gal. vacuum or Pressure Cooker with agitator and Vacuum pump, ASME 85#
- 5—Atm. Double Drum Dryers, 22" x 38", 24" x 60", 42" x 120"
- 6—Shriver 30" x 30" C.I. Filter Presses, open del 17 to 50ch.
- 1—Sperry 15" aluminum P & F Filter, 29 ch.
- 2—W & P 100 gal. Sigma Blade Jktd. Mixer
- 2—Pebble Mills 6' D x 8' L.
- 20—Aluminum Tanks — 500 to 3000 gal.
- 9—Copper Tanks, 1723 to 2800 gal.
- 30—Agitator Drives 3 to 40 HP
- 5—1200 sq. ft. Steel Shell & Tube Heat Exchangers—Used

HQ. FOR STAINLESS STEEL EQUIPMENT

USED EQUIPMENT IN STOCK

- 40—S.S. Storage Tanks from 10 gal. to 10,500 gal. sizes.
- 12—S.S. Pressure of Vacuum Tanks from 9 to 2600 gal. sizes.
- 15—S.S. Shell & Tube and coil type Condensers and Heat Exchangers from 14 to 785 sq. ft.
- 40—S.S. Jktd. open top Kettles from 40 gal. to 500 gal.
- 5—S.S. Jktd. agit. closed Reaction Kettles, 50, 100, 450, 500 gal.
- 7—S.S. Side Ent. Agitators 10 HP to 25 HP.

CONVERTING OR CHANGING EXISTING EQUIPMENT—
(Your own equipment or our stock)—Can be done in our own shops utilizing good used or surplus new materials.

FABRICATION—(IN OUR OWN SHOP)—Heliarc welding. Water-quenched stabilized welds. Large stock of type 304 and type 316 sheets and prefabricated tank sections and heads carried in stock assuring quick delivery of tanks.

Phone
ST evenson 4-7210
Cable—PERI

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ONE
of its
KIND

FOR SALE in NEW YORK HARBOR 160,000 Sq. Ft. BUILDING AREA 16-ACRE TRACT

- Deep Water Pier 400x65 Ft.
- Free Lighterage & Metropolitan Trucking Zone
- Heavy Construction
- 4,500,000 Gal. Liquid Storage
- Dry Storage—380,000 Bushels
- Process Steam—1100 HP—Oil Fired
- Power—3000KVA P.S. Connected Load
- Railroad Sidings—Truck Platforms
- Complete Sprinkler System—Tower Tank

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REALISTICALLY PRICED!**

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Jersey City,
N. J.
JO. Sq. 2-7100
or
Whitcomb
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Realtor-Exclusive Broker

AVAILABLE

CUSTOM REFINING FACILITIES . . .

- Complete Distillation Service • Distillations
- Extractions • Fractionations
- Drum Lots—Tank Cars
- All Types of Crude Mixtures
- By-Products, Residues, Wastes
- Contaminated Solvents

WANTED

Truland CHEMICAL &
ENGINEERING CO., Inc.
Box 426, Union, N. J. Murdock 6-5252

WANTED—SURPLUS

Chemicals—Dyes—Drugs
Colors—Pigments—Oils—Waxes
By-Products—Wastes—Equipment

CHEMICAL SERVICE CORP.
80-04 Beaver St. New York 5, NY

WE NEED

All Kinds of Oil Refinery and
Chemical Equipment, also Tanks
Write—Wire—Phone

Weinstein Co., Div. of Surplus &
Salvage Co., Inc.
810 West 8th Street Jamestown, New York

WANTED:

ROTARY KILNS and
LINK BELT ROTO
LOUVRE DRYERS.
ALL SIZES
WILL PAY CASH

W-6155, Chemical Engineering
330 W. 42 St., New York 36, N. Y.

LIQUIDATION

BATON ROUGE, LA.

OPERATED LESS THAN 30 DAYS

- 4—SHARPLES C-27 Super-D-Hydrators 316 SS vapor tight, XP timers and switches.
- 2—BUFLOVAK 6'x5'6" single drum monel Flakers.
- 1—LEADER 1000 gal. 316 SS jacketed, agitated Reactor.
- 1—SCHALLER 500 gal. 316 SS jacketed Reactor.
- 3—SCHALLER 4'x13' 316 SS Reactors with tubular calandrias 513 sq. ft. each.
- 1—PFAUDLER 250 gal. Hastelloy "C" Reactor.
- 2—I.R. Jet Refrigeration Units 208 and 136 tons.
- 1—PATTERSON 7'6" Conical Blender, rubber lined.
- 1—RIETZ 30' "Thermoscrew" Conveyor Dryer 304 SS
- 1—ALLIS CHALMERS 5'6"x25' Rotary Dryer.
- 1—ILLCO Duplex Ion Exchange Neutralizer 316 SS
- 1—PFAUDLER 390 sq. ft., 316 SS Heat Exchanger.
- 1—COLONIAL 5,000 gal. 316 SS Tank.
- 1—PFAUDLER 2300 gal. glass lined TANK.
- 2—LINK BELT Twin Screw Conveyors 316 SS, 18"x10', 18"x72'.
- 1—LINK BELT 40'6" cc Bucket Elevator 304 SS.
- 13—ALBERGER Karbate Heat Exchangers 431, 370, 255, 188, 170, 159, 70 and 16.4 sq. ft.
- 2—SCHALLER 93.8 sq. ft. nickel Heat Exchangers.
- 5—PFAUDLER 1200, 500 and 150 gal. glass lined Tanks.
- 2—316 SS HOPPERS 13,000 and 7500 gal.
- 7—KABATE Centrifugal Pumps Series 4A and 5A, 5HP XP motors.
- 5—LAWRENCE 316 SS Vertical Centrifugal Pumps 3" and 4" XP motors.
- 4—LINK BELT 12" rubber belt Conveyors, totally enclosed 30' to 77' cc.
- 7—STURTEVANT, American spark proof Blowers 7900 to 17,500 cfm XP motors.

SPECIAL NEW and USED

- 5,000 ft.—2" to 6" Saran lined pipe, fittings and 250 valves.
- 500 ft.—3" to 8" Stainless 316, Nickel, pipe, fittings, and 200 valves.
- 1,000 ft.—1" to 4" Glass Lined Pyrex, Karbate pipe and fittings.
- 100—Lapp Porcelain valves and fittings.
- 150—Instruments, Fisher Porter Flowmeters with Hastelloy and Tantalum fittings, Foxboro Temp Recorders, Rotometer, Mason Nielan Regulating Valves, Dowtherm pipe and fittings.
- 1,000—Explosion Proof lighting fixtures, Relay Boxes, circuit breakers, switches, etc. . . .

DETAILS ON REQUEST

YOUR INSPECTION INVITED

BRILL EQUIPMENT COMPANY

240 THIRD AVE., NEW YORK 51, N. Y.

A Company is known by the Companies it keeps...

... AS CUSTOMERS

Over the years BRILL EQUIPMENT COMPANY has filled the bill with reliable, rebuilt equipment for the leading Chemical Processing Companies . . .

DRYERS

- 1—Vulcan 8'x125' Rotary Kiln ¾".
- 3—Cummer 5'x40', 5'x30' Rotary.
- 1—Vulcan 4½'x50' Rotary.
- 1—Link Belt 6'4"x24" steel Roto-Louvre, Dryer Heresite coated.
- 1—Link Belt 3'10"x16" steel Roto-Louvre Dryer, furnace, oil burner, blower.
- 1—Devine #27 double door Vacuum Shelf, 17—59"x78" shelves.
- 1—Stokes Vacuum Shelf Dryer #138-H-10 44"x40" shelves.
- 2—Struthers Wells 5'x15' nickel clad Rotary Vacuum.
- 1—Devine 5'x10' steel Rotating Vacuum.
- 1—Stokes 30"x8', 3'x15' Rotary Vacuum.
- 4—Buflovak Double Drum 32"x100", 36"x84", 32"x72", 32"x52".
- 2—Buflovak 6' and 3' dia. Crystallizers.

FILTERS

- 3—Oliver Monel 8'x10', 3'x2' Rotary.
- 1—Oliver S.S. 8'x6' Rotary Vac.
- 2—Sweetland #12—72, 36 leaves.
- 2—Sweetland #3 all stainless.
- 1—Niagara 110 sq. ft. S.S.
- 1—Sparkler #33-S-17, steel.
- 1—Shriver 36" P&F 42 chambers.
- 4—Shriver 30" P&F 30 chambers.
- 8—Sperry 24" P&F 16 chambers.
- 2—Sperry Aluminum 30" and 24" P&F.
- 1—Sperry 36" P&F, heresite.
- 12—Filter Press Skeletons, all sizes.

SCREENS

- 4—#82 Rotex double deck 40"x120".
- 1—Patterson single deck 40"x84" S.S.
- 1—#23 Rotex three deck 20"x80".
- 3—Tyler Hummer, 4'x10', 4'x5'.

CENTRIFUGALS

- 1—AT&M 42" Suspended, 347 SS.
- 1—Bird 40" Suspended, 347 SS.
- 1—Bird 40" Suspended, rubber covered.
- 2—Tolhurst 40" Suspended, steel.
- 1—AT&M 36" rubber covered.
- 1—Fletcher 30" Suspended, steel.
- 1—Tolhurst 26" Suspended, steel.
- 2—Sharples PN Super-D-Canterers. SS.
- 2—Bird 18"x28" Continuous 310 SS.
- 2—Sharples C-27, C-20 stainless steel Super-D-Hydrators.
- 2—Sharples #16P Monel and S.S. Super Centrifuges.

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 - 3—Towers 6' x 58', 6'6" x 65', 7' x 25' SS.
 - 6—Pressure Vessels 150# to 325# WP 10' x 20', 8' x 16', 6' x 20', 5'3" x 38'6", 4' x 8', 3'10" x 38'.
 - 1—8'10" x 40'6", 150# WP Tank NEW.
 - 9—Centrifugal Pumps, 60 to 2000 gpm, XPL motors and turbines.
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PULVERIZERS—CRUSHERS

- 1—Devine 5'x10' steel, jacketed Mill.
- 1—Raymond Roll High Side Mill.
- 4—Hardinge Mills 4½"x16", 5"x22", 5"x36", 6"x22", 10"x48".
- 4—Patterson 6'x8', 5'x6', 3'x4' brick-lined Pebble Mills.
- 1—Patterson 5'x8' porcelain (Berylite) Pebble Mill, 50 HP. NEW.
- 3—National 10"x20", 8"x12" Mills.
- 3—Gayco Air Separators 12', 8', 18".
- 6—Mikro Pulverizers #4TH, #3TH, #2TH, #2DH.

MIXERS

- 1—Baker Perkins 100 gal. S.S. jacketed, Vacuum Mixer, 75 HP.
- 2—Baker Perkins 100, 50 gal. Sigma Blades, jacketed.
- 5—Sprout Waldron S.S. jacketed Powder Mixers, 67, 27 and 10 cu. ft.
- 1—Struthers Wells 6'x9' S.S. jacketed.
- 2—Baker Perkins 2 gal., stainless steel.
- 1—Robinson 4000# steel powder.
- 6—Rodgers 400 to 3000# powder.
- 3—Simpson Intensive Mixers #0.
- 8—NEW Portable Agitators ¼ to 5 HP.
- 4—Day, Ross 8 and 50 gallon, Pony.

KETTLES—REACTORS— CONDENSERS & TANKS

- 1—Buflovak 800 gal., 347 SS Clad, jacketed, agitated Reactor.
- 1—Buflovak double effect, Vertical SS Evaporator, 900 sq. ft.
- 6—Vaporators, single and multi-effect 300 to 14,000 sq. ft.
- 4—Foster-Wheeler Karbate Heat Exchangers 188 sq. ft.
- 9—Heat Exchangers S.S. 50 to 200 sq. ft.
- 5—Buflovak Condensers 20 to 90 sq.ft.
- 1—1400 gal. Aluminum Tank.

MISCELLANEOUS

- 5—Stokes Vacuum Pumps 10 to 50 cfm.
- 2—Stokes DD2, D3 Tablet Machines.
- 1—Kux Rotary Tablet Press 15, 25.
- 10—Nash Vacuum Pumps TS12, TS8, H8, H7, L3 MD571, #4, #2.
- 2—Cumberland #0 Rotary Cutters.
- 14—Olivite, Duriron stainless steel Centrifugal Pumps 1" to 6".

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- 1—Lightnin 2 hp., 1140 RPM. TEFC.
- 9—Lightnin D-2 1/2 hp., 431 RPM.

CENTRIFUGALS & CLARIFIERS

- 2—DeLaval 94-51, 3 hp. motor.
- 1—DeLaval SVK54 with 10 hp. motor.
- 1—DeLaval 94-21 with 5 hp. motor.
- 1—Fletcher 20", with coated perf. basket.
- 1—Fletcher 12", bronze perf. basket.
- 1—Fletcher 12", s.s. perf. basket.
- 1—Tolhurst 18" suspended, st. steel.

DRYERS

- 1—Porter Devine 2 x 4 vac. drum, 316 s.s.
- 1—Buffalo Vacuum Shelf, 5 1/2 x 42" shelves.
- 1—3' x 80" direct heat.
- 1—3' x 24" Hardinge direct heat.
- 1—Stokes vacuum, 20 shelves.
- 1—Devine 17 vacuum tray.
- 1—Buffave 32x90" double drum.
- 1—Buffave 32x100" double drum.
- 1—American 42x120" double drum.
- 1—Louisville 6x40" steam tube.
- 1—Grups 5x22" steam tube.

FILTERS

- Oliver 2 1/2 x 1', iron and steel.
- Denver 1 x 3' vacuum rotary.
- 1—Oliver 8x8" stain. steel.
- 1—Oliver 8 x 14' iron and wood.
- 1—Feine 10'6" x 16'.
- 12—Filter Presses: cast iron, alum., wood, from 7" to 30".
- 7—Internal Pressure—Alopp, Sparkler.

KETTLES

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- Pebble: Abbe porc. lined, 215 gal.
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- 3-roll Day 12 x 32, 16 x 40".
- Hammer: William BX, 60 hp.
- Hammer: Jeffrey 30 x 24 type A, 40 hp.
- Hammer: Raymond 16", 7 1/2 hp.
- Pulverizer: Micro 2DH, 10 hp. (New).
- Pulverizer: Micro 2TH, 15 hp.
- Hammer: Gump Bar-Nun, 20 hp.
- Pebble: Hardinge buhr. lined, 5' x 36".
- Imp: Raymond 240, 50 hp.
- Colloid: Charlotte 10, st. st., 3 hp.
- Colloid: Premier 3' s. st., 7 1/2 hp.
- Colloid: Premier U-3, 7 1/2 hp.
- 1—Raymond 21, 40 hp. motor.
- 1—Mills & Merrill 14 Shredder.
- 1—Charlotte colloid, s.s., 20 hp.
- 1—Sprout-Waldron 30" attrition.

MIXERS

- 4—Baker-Perkins 100 gal. jacketed.
- 7—Double arm sigma blade 5-100 gal.
- 14—Single arm sigma blade 30-100 gal.
- 18—Dry Powder—1 1/2 to 77 cu. ft. cap.
- 3—Day, Ross 40 gal. pony.
- 6—Olson & Tilgner 100-150 gal. lead-color.
- 1—Baker-Perkins 200 gal. Shredder.
- 1—Glen 120 qt. vertical.
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Raymond Imp Mills; Model OO, OOOO, #32, #41 with accessories.
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Patterson Buhrstone Lined Pebble Mills; 5'x8'; 6'x6' and 6'x8'.
Hardinge Conical Ball Mill, 10' diameter x 48" face.
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- 14—Sperry 18"x18" iron recessed Filter Presses, 18 chambers.
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- 3—450 gal. S.S. Steam Jcktd. Kettles.
- 1—Bullovak 48"x40" Drum Flaker, chrome plated, S/S ends.
- 1—Oliver Rotary Filter, 6"x6", Acid Construction.
- 4—Mojonnier, S.S. Vac. Pans, 3'x5'x6".
- 3—6"x6" Louisville Rotary Tube Dryers.
- 1—Day size 30 Imperial Jacketed 75 gal. Sigma Blades.
- 1—2TH. Mikro Pulverizer.
- 4—Bullovac Atmo. Dbl. Drum Dryers 24"x36", 32"x90", 42"x120".
- 3—Anco 4"x8" Chilling Rolls.
- 5—Horiz. Ribbon Dry Mixers, 4000 lb., 1500 lb., 500 lb.

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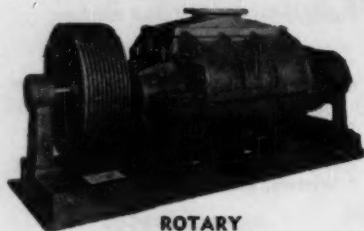
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- 1—Mikro #2TH Stainless Steel Pulverizer.
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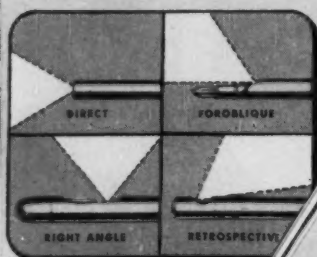
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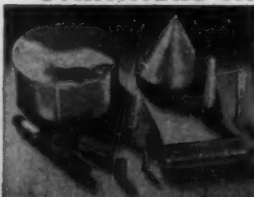
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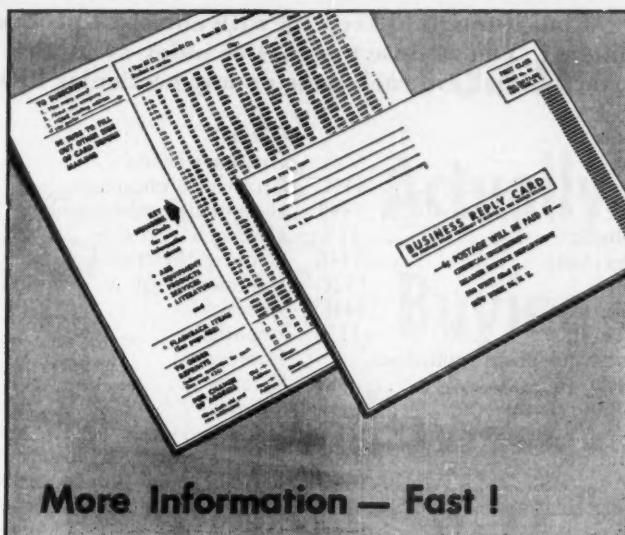
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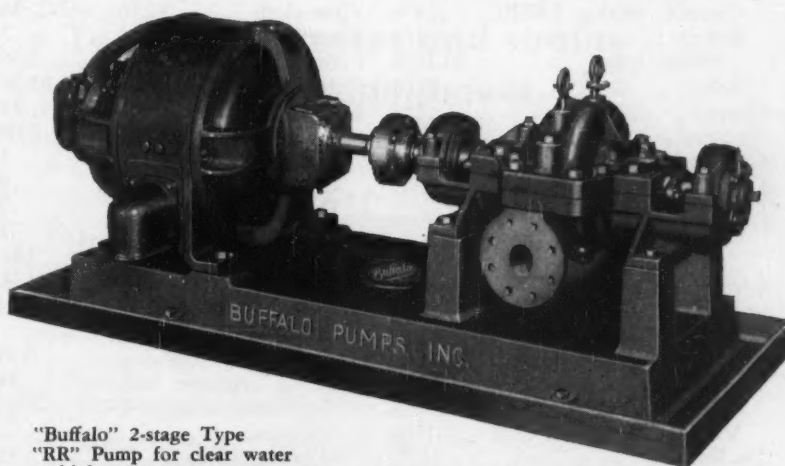
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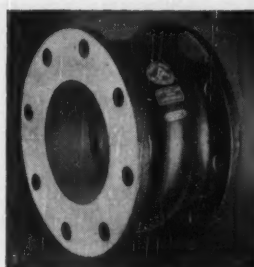
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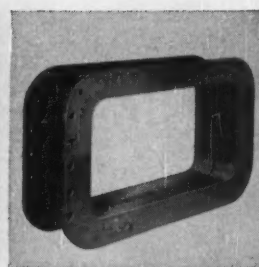
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Spool-type
Rubber Expansion Joint

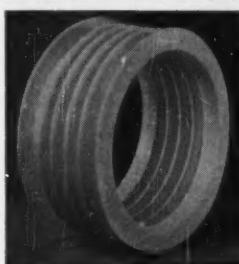


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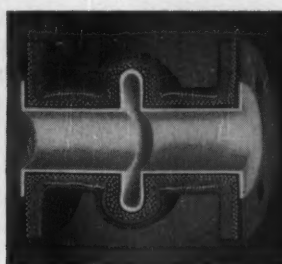


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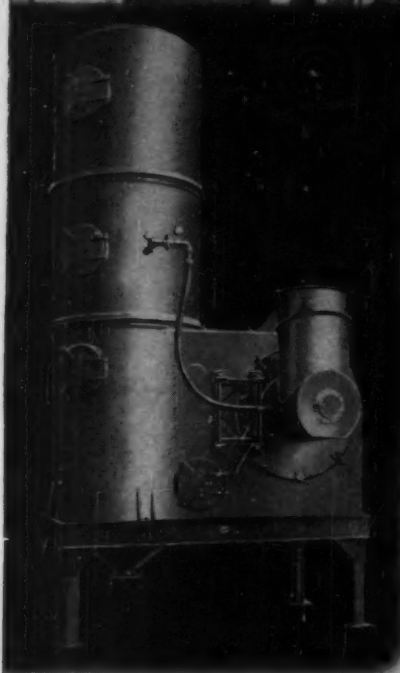
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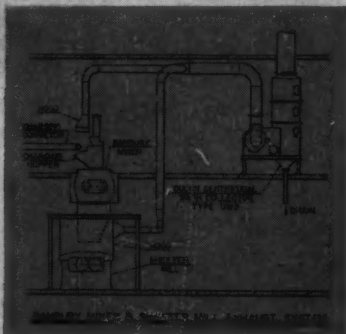
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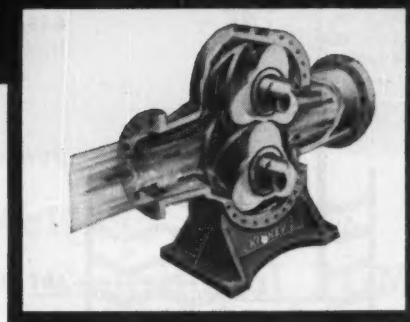
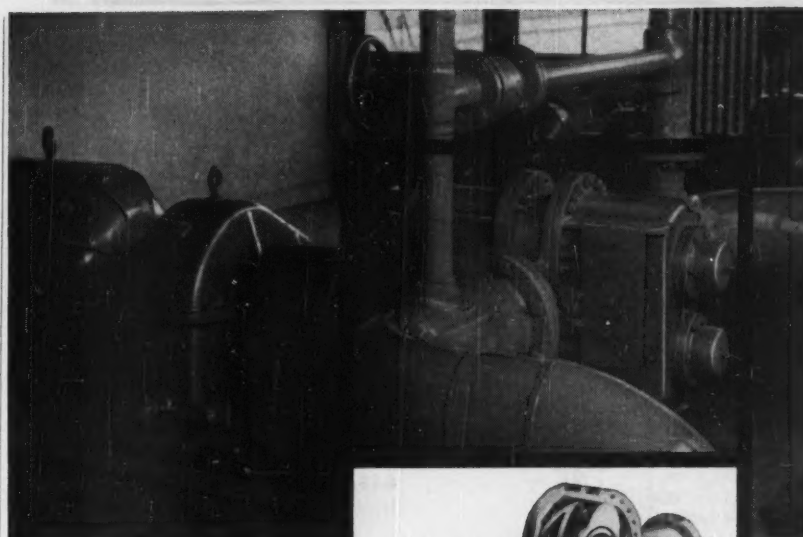
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THE NEW YORK AIR BRAKE COMPANY

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Please send Bulletin L51 describing the complete line of Kinney Liquid Pumps.

Name.....

Company.....

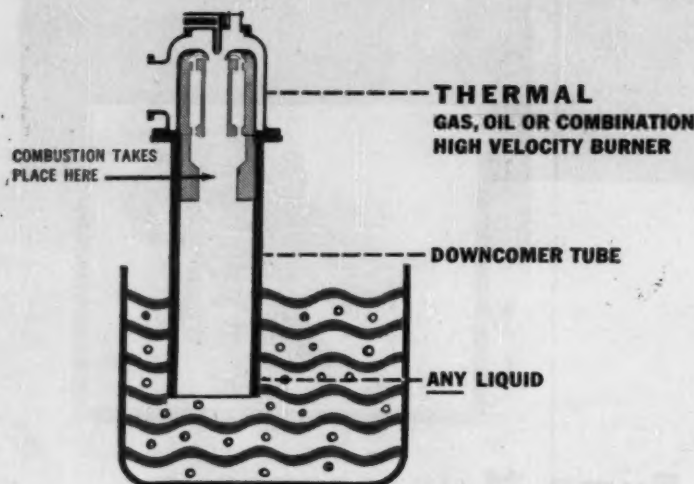
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SUBMERGED COMBUSTION

in a form so simple it can be used with
ANY LIQUID HEATING PROCESS!



USE ANY THERMAL BURNER . . .

With heat release characteristics of over 10,000,000 BTU/hr/cu ft readily feasible, extreme compactness is easily obtained. The THERMAL burner is completely separate from the liquid being heated and maintenance is therefore greatly simplified.

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Successful tube materials have been developed for all corrosive liquids as well as for heating liquids to as high as 2,500°F.

HIGH VELOCITY AIDS TRANSFER . . .

THERMAL burners develop exit velocities as high as 500 ft/sec. Additional turbulence obtained by forcing the products of combustion through the liquid promotes speedier, more uniform heat transfer.

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Gas, Oil & Combination Burners
• Air Heaters • Combustion
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Thermal Research & Engineering Corp.

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REPRESENTATIVES IN PRINCIPAL CITIES

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Flashback

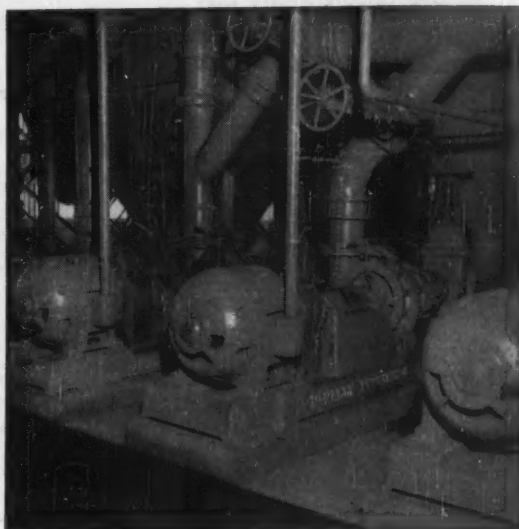
To make sure that you don't miss any news that could help you with your job, Chemical Engineering is doing a double take on you. The index below repeats the editorial listings only on chemicals, equipment and service featured last month in New Equipment and in Chemicals and Raw Materials. Use the postcard (p. 443) for more information on any items.

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McNally Centrifugal PUMPS

Special Built McNally Pittsburg centrifugal pumps are used to handle abrasive and corrosive sludges, slimes, and slurries. They give maximum pumping service for years.

In these slurry pumps, the volute, impeller, wearing plate and suction nozzle are cast of McNally specification NiHard. The pumps are of open impeller, single stage type. They are direct connected, or v-belt driven, depending on the type of service and installation requirements.

SPECIAL DESIGN

McNally Pittsburg designs special centrifugal pumps to your requirements; or builds special pumps to your design. For Information Write to Either Plant.

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Heavy Machining	Platework
Stress Relieving	Structural Steel

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What It Contains . . .

This is a comprehensive listing of the latest literature you can now get from manufacturers on chemicals, equipment and services in all fields of interest to chemical engineers. It lists new publications just released, in addition to technical literature mentioned in the advertisements in this issue. The latter are identified by an asterisk (*) alongside the company name.

For More Information . . .

You can get—and get fast—more information on any publication listed in this guide by using the Reader Service postcard inside the back cover. Simply circle the item's code number on the postcard, fill in your name and address, then mail to us. Ask for as many as you need. Answers come to you direct from the companies putting out the literature.

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Guide to Technical Literature

Want to build up your files and keep them up-to-date?

This comprehensive guide to available literature will help you do just that. They're yours—free—for the asking.

Chemicals

Acid, Sorbic......Company makes available a reference containing detailed technical information—physical properties, solubility data, net container weights, uses, a bibliography, etc. Request No. F-8526.
444A Carbide & Carbon Chem.

Acid, Undecylenic......A high degree of chemical reactivity is assured thru structural features rarely found in fatty acids, such as an odd number of carbon atoms & vinyl unsaturation. Property Sheet & Search Report.
444B Baker Caster Oil Co.

Acids, Fatty......Metallic soaps made from Neo-Fat 10 have desired compatibility with vinyl films & do not contribute to cloudiness, bloom or yellowing in finished products. Sample & Coco Fatty Acids Booklet.
444C Armour Chem. Div.

Alcohol, Isooctyl......Indoil isooctyl alcohol is of outstanding esterification quality. An excellent solvent & a starting point for various chemical syntheses. Request product sample & Technical Bulletin 22.
444D Indoil Chem. Co.

Aluminum Chloride, Anhydrous......Offers 4 sizes for almost every processing need: fine grind; extra fine grind; coarse grind; coarse screened. Information in Data Sheet. Bulletin 100 covers products and services.
381 *Hooker Electrochem Co.

Aluminum Octoate......Finds wide application in printing inks, where it contributes body without the loss of gloss. Physical properties, solubility, gelling properties, etc., in Technical Service Bulletin G-2.
444E Witco Chem. Co.

Anti-Oxidants......Announces newly developed anti-oxidant, "Compound 19." Effectively prevents odor & color reversion in alkyl aryl sulfonates & is now being used commercially for this purpose. Data & samples.
444F Sindar Corp.

Bauxite......New 68 p. illustrated booklet features data on various grades of bauxite & other Alcan chemicals, including chemical formulae, chemical & physical properties, suggested uses & packing information.
444G Aluminum Ltd. Sales.

1,4-Butanediol......A glycol with plus values in plasticizers, polyesters, polyurethanes. Almost colorless, odorless liquid, f.p. range 18-19.5° C, b.p. range 221-231° C. Product sample & technical information.
444H General Aniline & Film Corp.

Calcium Acetate......B&A purified calcium acetate is a white, free-flowing powder made from selected raw materials. Features extremely high purity plus superior physical characteristics. Sample and Data Sheet.
119 *General Chem. Div.

Calcium Carbonate......Purecal SC is new coated ultrafine calcium carbonate. It disperses readily, & is entirely different from any other coated calcium carbonate on the market. Product samples & full information.
444I Wyandotte Chem. Corp.

Carriers, Catalyst......Alundum carriers prove highly successful in reactions such as those involved in manufacture of phthalic anhydride, maleic anhydride and oxidation of ethylene. Full details in Bulletin No. 7.
32-3a *Norton Co.

Catalysts......Presents a fully illustrated reference describing line of catalysts—tableted, extruded, spherical, granular, powdered. Includes detailed information on the history and the numerous uses. 8 p.
444J Harshaw Chem. Co.

Ceramic Materials......Illustrated 20 p. lists ceramic materials available thru company. Includes body & glaze stains, underglaze & overglaze colors, porcelain enamel oxides, antimony oxide, nickel oxide, etc.
444K Harshaw Chem. Co.

Chelating Agents......Cheelox B-14 is the new, all-purpose chelating agent which is soluble and stable at all temperatures in neutral, acid and alkaline solutions. Makes available sample and technical information.
243 *Antara Chem.

Chemicals, Molybdenum......New bulletin designed as an aid in finding sources of molybdenum compounds. Lists all molybdenum chemicals available in commercial or experimental quantities. Bulletin Ch-6.
444L Climax Molybdenum Co.

Chloromethanes......28 p. contains up-to-date information on: methyl chloride; methylene chloride; chloroform; carbon tetrachloride. Includes physical and chemical properties, data on use, handling, storage, etc.
149a *Solvay Process Div.

Copper Naphthenate......Witco 8% copper naphthenate is a dark green viscous liquid. It is a highly effective, economical fungicide & preservative for all cellulosic materials. Data in Technical Service Bulletin P-15.
444M Witco Chem. Co.

Crotonaldehyde......Eastman crotonaldehyde—denaturant... chemical intermediate... specialty solvent... etc. Company makes available upon request complete product information in addition to samples.
444N Eastman Chem. Products.

Crystals, Optical, Synthetic......Used for infra-red & ultra-violet optics, piezoelectric effects & short wave radiation detection. 36 p. describes sodium chloride, potassium bromide, potassium chloride, etc.
444O Harshaw Chem. Co.

Curing Agents, Amine......Wide selection enables you to select the preferred "pot life" for your epoxy resin application... from a few minutes to several hours. Data in Technical Information Report F-8665.
444P Carbide & Carbon Chem.

Cyanacetamide......Now used in syntheses of vitamins & barbiturates. Suggested as an intermediate for special resins, substituted piperidines & pyridones, new pharmaceuticals, etc. Offers Technical Data Bulletin.
444Q Kay-Fries Chem.

Cyclohexanol......"Hexalin" cyclohexanol is a good solvent for several classes of dyes including basic, chrome, some acid & the majority of acetate rayon dyes. Describes properties, specifications, uses, etc.
444R E. I. du Pont de Nemours.

Defoamers......For more efficient foam control. Versatile defoamers save space now wasted on foam, cut the processing time, eliminate waste & fire hazard of overflowing foam, etc. Offers complete data & samples. R361 *Dow Corning Corp.

p-Dichlorobenzene......Your packaging and selling jobs are easier with Paradi's exclusive seven sizes. Makes available a descriptive folder containing information on handling and use. Request copy of Bulletin 454. 445A Hooker Electrochem. Co.

Dichloromaleic Anhydride......Potential applications include: curing agent for epoxy resins; preparation of resinous plasticizers; modifying acid in polyesters; intermediate; etc. Samples & Technical Data Sheet. 445B Westvaco Chlor-Alkali Div.

Dicyandiamide......Animal glues stay fluid for days with less than one percent of Cyanamid's dicyandiamide (based on dry solids) added as the fluidizer. Company makes available literature & products samples. 14-5c *American Cyanamid Co.

Di-2-Ethylhexyl Adipate......A colorless, high-boiling, liquid linear ester of outstanding value as a primary plasticizer for vinyl resins. Furnishes a complete description in Technical Service Bulletin E-3. 445C Witco Chem. Co.

Dioctyl Phthalate......Produces a truly high quality dioctyl phthalate whose combination of low color, low odor, low acidity, high heat stability & high ester content is unsurpassed. Offers specifications & samples. 445D Eastman Chem. Products.

Driers......For paint, varnish, printing ink and allied industries. Fully illustrated booklet describes company line of driers, the modern plant in which they are produced, and the new research laboratories. 36 p. 445E Harshaw Chem. Co.

Ethyl Bromide......One of Dow's numerous intermediates—helps make chemical synthesis easier & is usefully applied from laboratory to full-scale production. Offers detailed information & an experimental sample. 445F Dow Chem. Co.

Ethyl Silicate......20 p. illustrated folder contains general background information on the use of ethyl silicate in precision casting. Includes complete physical properties and specifications. Booklet F-8265. 445G Carbide & Carbon Chem.

Formaldehyde......Low in formic acid & iron, Mathieson formaldehyde meets the most rigid specifications for purity & uniformity. Available in: 37% inhibited; 37% low methanol; 45% low methanol. Full details. 445H Olin Mathieson Chem. Corp.

Formaldehyde......Trioxane—a crystalline form of formaldehyde—now available in continuing commercial quantities for the first time. Physical properties, specifications, uses, etc., in Product Bulletin No. N-31-2. 445I Celanese Corp. of America.

Fullers Earth......Makes available a new reference on Permagel, Attasorb and Attasol as thickening, gelling and suspending agents for organic or aqueous system. Request your copy of Technical Data Sheet SD-29. 445J Minerals & Chem. Corp.

Fumigants......Carboxide fumigant—the efficient & safer fumigant for insect control in passenger equipment. Covers features: safety record, 100% effectiveness, economy, easy application. Request Booklet F-6950. 445K Carbide & Carbon Chem.

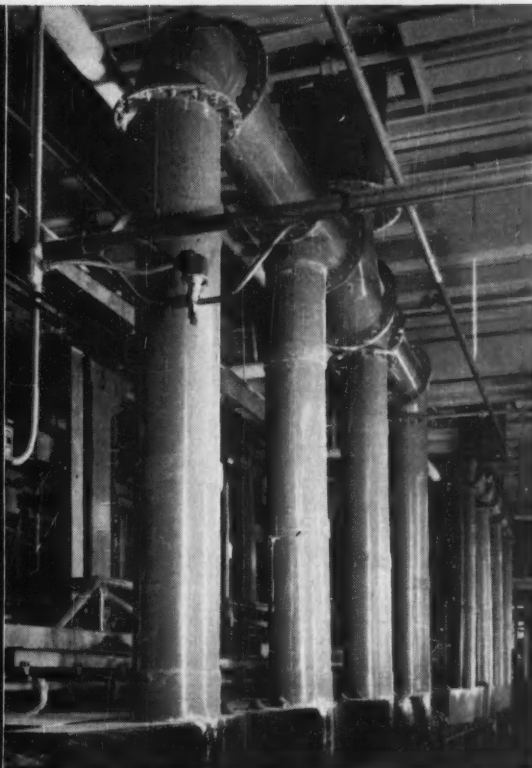
Glyoxal......Since Carbide first made glyoxal, this versatile dialdehyde has found important uses in nearly every industry. For complete information, request booklet, "Glyoxal & Pyruvic Aldehyde," No. F-7607. 445L Carbide & Carbon Chem.

SULPHURIC ACID FUMES HARMLESS

to Duct System made of

Boltaron
6200
unplasticized PVC

"We have done
no maintenance
since it was
installed 16
months ago,"
says Dexter Lock
Company, "We
are well satisfied."



DEXTER LOCK'S HUGE RISERS of Boltaron 6200 are shown off the anodizing tanks, going up and through the roof where other Boltaron ducts carry fumes into exhaust fan. "We are well satisfied with the Boltaron 6200 duct system and the service we have received from the Boltaron Fabricator, Carpart Corp., Owosso, Michigan" reported the Company spokesman.

GRAND RAPIDS, MICH. — Boltaron 6200 has done it again. The awesome problem of handling sulphuric acid fumes for months — *perhaps years* — without maintenance, replacement or costly shutdowns has been solved at Dexter Lock Company, a subsidiary of National Brass Company. The answer was *and is* Boltaron 6200.

Highly versatile and readily adapted to complicated shapes, Boltaron 6200 has chemical resistance to both strong and weak organic and inorganic acids, alkalies, alcohol and foodstuffs. It is non-metallic and only half the weight of aluminum. Available in sheet, pipe (and fittings), rod and block stock, Boltaron can be drawn, formed, molded, machined and hot air welded.

Whatever your problem, experienced engineers and fabricators coast to coast and in Canada are ready to help you. Write Box 118 for complete information.

H. N. HARTWELL & SON, INC.

Industrial Plastics Division, Park Square Bldg., Boston, Massachusetts
NEED EXTRA IMPACT STRENGTH? Ask about Boltaron 7200.

* See explanation on p. 444

LITERATURE . . .

Greases, Silicone.....Announces availability of a new fully illustrated brochure on Dow Corning 41 Grease—a silicone fluid-carbon black mixture designed for high temperature, slow speed bearings. 6 p.
446A Dow Corning Corp.

Guanylurea Phosphate.....Cyanamid's guanylurea phosphate proven to be an effective corrosion inhibitor in the new water-based latex-type paints. Announces the availability of product samples and detailed literature.
14-5d *American Cyanamid Co.

Hydrogen Peroxide.....Hydrogen peroxide dry-in process for bleaching wool—describes wool bleaching process, its effect on dyeing properties of wool & a method for improved acid dyeing of bleached wool. Bulletin 29.
446B Buffalo Electro-Chem. Co.

Hydroxyethyl Cellulose.....Cellulose hydroxyethyl cellulose is a water-soluble, free-flowing, white to light tan powder. Reference covers preparation of Cellulose solutions, properties, uses, etc. No. F-8544A.
446C Carbide & Carbon Chem.

Inhibitors, Rust & Corrosion.....Illustrated, 24 p. describes Santolene C rust inhibitor. Covers use in petroleum pipelines, use in oil tankers, effect on specific products, etc. Technical Bulletin No. O-62.
446D Monsanto Chem. Co.

Insecticides.....Malathion, versatile insecticidal chemical 0-0-dimethyl dithiophosphate of diethyl mercaptosuccinate, features record of plant safety on ornamentals. Literature & samples.
14-5a *American Cyanamid Co.

Isophthalic.....Household and industrial paints, varnishes, enamels, polyesters will all benefit from superior properties contributed by new Oronite Isophthalic. For complete information, request Technical Bulletin.
151 *Oronite Chem. Co.

Isopropanol.....Offers new 16 p. reference containing information on the uses, physical & physiological properties, shipping data, specifications, & constant-boiling mixtures of isopropanol. Booklet F-8731.
446E Carbide & Carbon Chem.

Ketones.....Have many varied applications as solvents & intermediates in industrial processes. Valuable data on acetone, Solvaton solvent, diethyl ketone, synthetic methyl acetone, etc. in 48 p. Book F-4767C.
446F Carbide & Carbon Chem.

Ketones, Fatty.....Company's high-melting Stearone useful in waxes, inks and paint. Request samples and Bulletin G-1 which furnishes valuable information on Stearone and other profitable Armour fatty ketones.
446G Armour Chem. Div.

Latex.....Announces the release of informative literature—a pamphlet which describes the properties, applications and processing of special latex. Request Service Bulletin L-6, "Geon Latex 450 x 167."
446H B. F. Goodrich Chem. Co.

Latex, Paint.....When tested against samples of competing latices, Gen-Flo proved best balanced latex—either equal to or better than other products in all vital requirements. Reference data and sample.
446I General Tire & Rubber Co.

Lithium Amide.....Molecular weight—22.964; color and form—white crystalline; density—1.178 g./cc. at 17.5°C.; melting range—380-400°C.; etc. Makes available a Data Sheet providing complete information.
446J Lithium Corp. of America.

Lithium Borohydride.....Offers technical information on lithium borohydride. Features valuable uses: organic reducing agent; hydrogenation agent; hydrogen generation; etc. Find complete details in Bulletin 402.
446K Metal Hydrides.

Lithium Stearates.....Offers detailed report, "Lithium Stearates for the Grease Industry," which covers typical properties, packing data, performance in various base oils, etc. Technical Service Bulletin M-12.
446L Witco Chem. Co.

Lithium Titanate.....Uses—ceramics: (enamels)—as a mill addition in titanium-bearing enamels for effecting lower burning; (glazes)—used as a mill addition in vitreous & semi-vitreous glazes; etc. Data Sheet.
446M Lithium Corp. of America.

Lubricants.....The superior non-sludging characteristics & burn-off properties of Ucon synthetic lubricants indicate their suitability for certain high temperature applications. Details in Booklet No. F-7404.
446N Carbide & Carbon Chem.

Lubricants, Molybdenum Disulfide.....Describes Moly-Spray-Kote, a carefully-compounded dispersion of micro-fine molybdenum disulfide in a self-pressurized aerosol-type sprayer. Request Bulletin 102.
446O Alpha Corp.

Methanol.....For dependable deliveries of methanol of the highest quality. Shipments from Morgantown, W. Va. can be made in 8 & 10,000-gallon tank cars, compartmented tank cars, barges, etc. Data & samples.
446P Olin Mathieson Chem. Corp.

Methylamines.....Twenty years experience in producing & handling methylamines assures you products of high purity & uniform, dependable quality. Detailed, authoritative literature covers use of these products.
446Q Rohm & Haas Co.

Molybdenum.....A flow chart showing how molybdenum is manufactured and controlled quality-wise from oxide to finished product featured in 20 p. book. Also properties, processing, product use, etc. No. NP-428.
446R Sylvania Elec. Products

Naphthas, Aromatic Petroleum.....Complete series of petroleum fractions enables many manufacturers to select suitable substitutes for the common coal tar solvents at a substantial savings. Samples & data.
446S Pennsylvania Indus. Chem.

Oils, Heat Transfer.....If your heat transfer requirements go up to 600° F., you will find that S/V Heat Transfer Oil 600 is the best medium you can use. Bulletin offers complete information on benefits.
77 *Socony-Vacuum Oil Co.

Oils, Heavy.....Characteristics of heavy oils make them ideal for weed killing oils, sludge solvents & tar cutbacks. Also useful in the manufacture of insecticides & disinfectants. Specifications & samples available.
446T Pennsylvania Indus. Chem.

Paraformaldehyde Powder.....Celanese offers a general purpose, fine ground paraformaldehyde suitable for all powder applications. Covers physical properties, specifications, uses, etc., in Bulletin No. N-17-5.
446U Celanese Corp. of America.

Peroxygen Compounds.....Surface treatment of metals with peroxygen compounds—survey of recommended procedures for passivating, cleaning, etching, stripping, oxidizing and coating metal surfaces. Bulletin No. 39.
446V Buffalo Electro-Chem. Co.

Phenol.....Company operates as one of the world's major producers of phenol. Announces the availability upon request of a valuable booklet containing information about the properties, uses, handling, etc.
446W Dow Chem. Co.

Phosphorous, Elemental.....Whether used in 99.9% pure elemental form or in ever-widening range of phosphorus derivatives & compounds, company's line assures highest quality & uniformity. Literature & samples.
446X American Agricultural Chem.

Plasticizers.....For plasticizers, it's Ohio-Apex—phthalates...phosphates...adipates...fatty acid esters...specialties...etc. Furnishes complete information & technical data upon request.
446Y Ohio-Apex Div.

Plasticizers.....40 p. reference offers latest laboratory findings on lacquers & lacquer plasticizers. Covers specifications, characteristics, properties, formulations, applications, etc. Technical Bulletin 76-A.
446Z Archer-Daniels-Midland Co.

Plasticizers.....Stabilizing effect of Paraplex G-62 in vinyl compounds demonstrated during tests under intense sunlight. Properties & data in "What You Should Know About the Paraplex & Monoplex Plasticizers."
446AA Rohm & Haas Co.

Plasticizers.....You save with Flexol Plasticizer 426 (a distilled, mixed alcohol phthalate of uniform quality)—it's low in price, low in specific gravity, and high in solvent power. Literature and sample.
446BB Carbide & Carbon Chem.

Plasticizers, Vinyl.....Epoxy fatty acid ester plasticizers—an investigation of the performance of epoxy fatty acid esters as vinyl plasticizers. For a copy of valuable article reprint, request Bulletin No. 56.
446CC Buffalo Electro-Chem. Co.

Polyvinyl Acetate Emulsions.....Line includes 4 standard Darex polyvinyl acetate polymers & 4 special copolymers with unusual qualities. Covers properties, features & typical end uses in new Brochure No. E-12.
446DD Dewey & Almy Chem. Co.

Polyvinyl Acetate Emulsions.....PVA series of polyvinyl acetate emulsions—both homopolymer & copolymer types—is available for immediate shipment. Request valuable Bulletin on PVAc emulsions for paints.
446EE Celanese Corp. of America.

Polyvinyl Acetate Emulsions.....You can have a better product at lower cost with Vinac polyvinyl acetate emulsions—for paints...concrete...adhesives...paper...etc. Data and product samples.
446FF Colton Chem. Co.

Polyvinyl Materials.....Company presents valuable reference, "Geon Polyvinyl Materials for Industrial and Consumer Uses." Contains 10 p. of photographs and typical applications of various types of Geon.
446GG B. F. Goodrich Chem. Co.

Potash, Caustic.....Mercury cell caustic potash, a grade that sets new standards for purity—and at a price no higher than ordinary premium grade low chloride material. Samples, prices, technical data.
446HH Solvay Process Div.

Resins.....Company announces the release of a new Technical Bulletin which describes its line of phenolic-type laminating resins. Detailed properties of the resins & the finished laminates included in reference.
446II Synvar Corp.

Resins, Petroleum.....Extremely low cost of Piccopale, & its availability in enormous quantities make this new type of petroleum resin ideal for use as a basic raw material. Request copy of descriptive Bulletin.
446JJ Pennsylvania Indus. Chem.

➔ Want more information on any of these items? Just circle its code number on the postcard inside the back cover, then mail to us. It's that easy now.

Resins, Polyester.....Lighter, tougher plane bodies...with Polylyte polyester resins—a great new basic material for aviation and scores of other industries. For details, request Polylyte Brochure PR.
447A Reichhold Chem.

Resins, Vinyl Plastisol.....Technical information on properties, compounding and application of Opalon 410 vinyl plastisol resin is contained in a new 22 p. report. Liberally illustrated with charts and graphs.
447B Monsanto Chem. Co.

Silica Gel.....A superior drying agent for natural gas. For detailed information and field performance data on the use of Davison silica gel for the drying of natural gas, request Technical Bulletin No. 201.
90 *Davison Chem. Co.

Silicates, Soluble.....Manufacturers of soluble silicates makes available upon request a new folder covering the subject of treating concrete. Request your copy of "Treating Concrete with O Silicate." 6 p.
447C Philadelphia Quartz Co.

Sodium Dispersions.....The numerous ways that sodium dispersions can be used to speed chemical reactions—& make possible new reactions—outlined in brochure, "Using 'Ethyl' Sodium in Dispersed Form." 32 p.
447D Ethyl Corp.

Sodium Fluoride.....Widely used for public water fluoridation. AA Quality sodium fluoride and sodium fluosilicate combine uniformity with quality. Makes available a descriptive Data Sheet and product samples.
447E American Agricultural Chem.

Sodium Phosphates.....Company announces availability of newly published reference—an easy-reading booklet giving a complete review of technical & commercial aspects of phosphates today & in the future.
447F Monsanto Chem. Co.

Sodium Sulfite Anhydrous Photo Granular.....Fine, white, free-running crystalline granules; odorless. Chiefly used in photographic developing and fixing solutions. Details in Technical Information Sheet.
447G Mallinckrodt Chem. Wks.

Sodium Trimethoxyborohydride.....White porous powder, m.p. 230°C., with decomposition. Evolves hydrogen with water. Soluble in organic solvents. Makes available complete product information in Bulletin 504.
447H Metal Hydrides.

Solvents, Organic.....New revised 64 p. handbook on organic solvents tells about: flash point; toxicity; dry time; solvent power. Reference includes definitions, comparison tables, testing methods, etc.
447I Solvents & Chem. Group.

Solvents, Petroleum.....Manufacturer makes available a Buyers' Guide to petroleum solvents and their properties. Lists aliphatic naphthas, paraffinic hydrocarbons and aromatic hydrocarbons and solvents.
447J American Mineral Spirits.

Sorbitol.....Investigate sorbitol for making paint resins. Makes available booklet, "Sorbitol Resins," containing specific formulas for a number of sorbitol-based resins, with instructions for preparation.
447K Atlas Powder Co.

Stabilizers.....Stayrite #90 is a new addition to line of stabilizers for polyvinyl chloride resins, developed to meet the most rigorous toxicity specifications. Data & properties in Technical Service Bulletin S-7.
447L Witco Chem. Co.

Stabilizers, Vinyl.....Company announces the availability of two new Technical Data Sheets containing valuable information on vinyl stabilizers. Advastabs T-72 & BA-13P. Includes advantages and specifications.
447M Advance Solvents & Chem.



NOTHING BEATS **Teflon**^{*} FOR PACKING CHEMICAL PUMPS

Everywhere they're being used on chemical pumps and valve stems, packings made of R/M "TEFLON" are doing a tremendously efficient job. With their help, it is possible to meet most any chemical packing problem. Carefully engineered and custom-built

for their applications, they are lasting longer in service and lengthening the life of the equipment they're used on. Actually, they're going a long, long ways towards making preventive rather than corrective maintenance possible. Write for complete information.

^{*}Du Pont's trade-mark for its tetrafluoroethylene resin

**R/M MAKES A COMPLETE LINE OF PACKINGS AND GASKETS—
AVAILABLE FROM YOUR R/M DISTRIBUTOR**

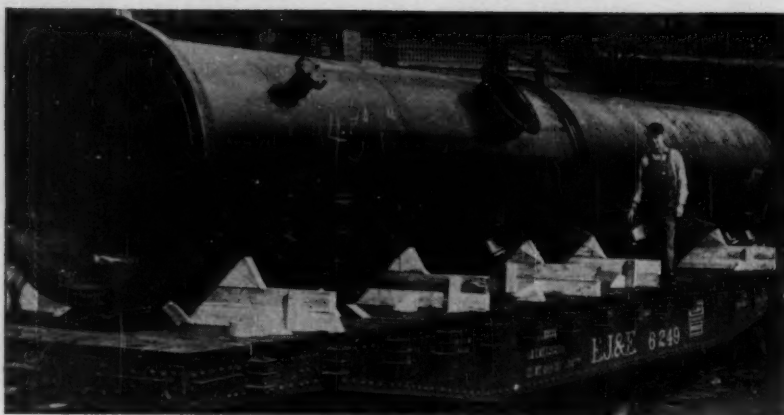
R/M

PACKINGS
RAYBESTOS-MANHATTAN, INC.
PACKING DIVISION, MANHEIM, PA.

FACTORIES: Bridgeport, Conn.; Manheim, Pa.; No. Charleston, S.C.; Passaic, N.J.; Neenah, Wis.; Crawfordsville, Ind.; Peterborough, Ontario, Canada

RAYBESTOS-MANHATTAN, INC., Packings • Asbestos Textiles • Industrial Rubber, Engineered Plastic, and Sintered Metal Products • Abrasive and Diamond Wheels • Rubber Covered Equipment • Brake Linings • Brake Blocks • Clutch Facings • Fan Belts • Radiator Hose • Bowling Balls

* See explanation on p. 444

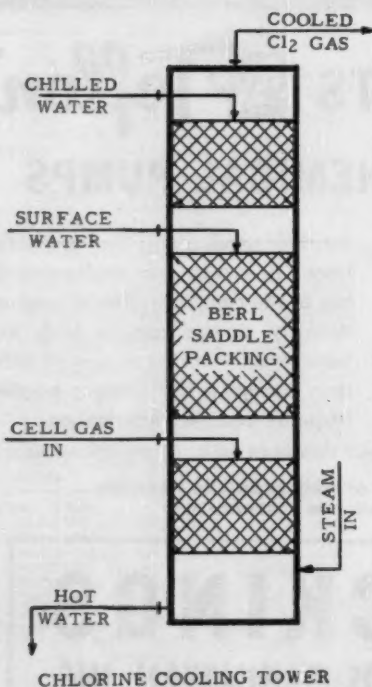


Pyroflex Lined Chlorine Cooling Tower

KNIGHT Custom-Built COOLING and DRYING TOWERS

The Knight process for cooling and drying chlorine cell gas utilizes direct countercurrent contact in packed towers. The illustrated tower cools wet chlorine gas with surface water followed by chilled water. The dissolved chlorine is stripped from the water with steam. The cooled chlorine gas is dried in three stages with sulphuric acid. The heat evolved is removed by external cooling.

Why Knight Chlorine Cooling Towers Are Widely Used



1. Reliability — no loss of efficiency or down time due to fouling or plugging.
2. Efficiency — dew point of gas reduced to within 5°F of water temperature.
3. Economy — two-stage design reduces consumption of water — refrigeration and sulphuric acid.
4. High capacity Berl Saddle Packing provides maximum contact area with minimum pressure drop.
5. Corrosion resistant — Pyroflex construction is inert to chemical attack and thermal shock.
6. Guarantee — a unit engineered for the job to insure rated capacity under design conditions.

Knight engineers design and construct towers for HCl absorption and stripping, H_2SO_4 fume elimination, CO_2 and SO_2 recovery and hot gas cooling. They will evaluate your problem without obligation.

Maurice A. Knight 105 Kelly Ave., Akron 6, Ohio
Acid and Alkali-proof Chemical Equipment

LITERATURE . . .

Surface Active Agents. New product information booklet covers Sponics, nonionic surface active agents. Describes the physical properties and many uses of three new Sponics now available through the firm.
448A American Alcolac Corp.

Titanium Hydride. Features numerous uses: ceramic-metal seals; electronic getter; furnace atmosphere; hydrogenation agent; refractories; etc. For complete product information, request Bulletin No. 801.
448B Metals Hydrides.

Uranium. New edition of "Mesa Miracle" describes fast-growing uranium industry on the Colorado Plateau. Includes up-to-date figures on number of uranium mines now in operation & the people employed. 36 p.
448C U. S. Vanadium Co.

Construction Materials

Asbestos Base Reinforcing Materials Illustrated, 48 p. describes three lines of asbestos base reinforcing materials which company introduced to low pressure branch of plastics industry. Bulletin No. T-55.
448D Raybestos-Manhattan.

Brick, Refractory. 36 p. on the use of periclase-chrome refractory brick to line cement kiln hot-zones. Offers technical data on brick, instructions for installation, ordering, shipping & handling, etc.
448E Kaiser Aluminum & Chem.

Castings. Corrosion-resistant castings from created metals . . . to help solve your tough product design problems. Offers 40 years of experience in producing top quality castings. Descriptive literature.
223 *Waukesha Foundry Co.

Castings, High Alloy. Duraloy high alloy castings to your order . . . large —small—special shapes—corrosion-resistant—heat resistant—abrasion-resistant—etc. Offers details in Bulletin No. 3354-G.
365 *Duraloy Co.

Cements, Insulating. Super "66" insulating cement sticks to hot or cold surfaces—saves time, saves money. Contains a special rust inhibitor that prevents corrosion. Makes available a product sample on request.
70 *Eagle-Picher Co.

Coating Systems, Protective. Modern approach to maintenance-painting halts corrosion. Sixteen specialized protective coating systems cover requirements of hundreds of strong corrosives. Bulletin MC-8.
402a *United Chromium.

Coatings, Protective. "ATD" hot spray paint offers maintenance man & corrosion engineer a lower cost, surer way to protect plant & equipment against corrosive attack. Literature describes use & advantages.
106 *U. S. Stoneware Co.

Coatings, Protective. For any equipment or surface that can be uniformly baked. . . . Plastisol compounds offer easy, economical way to apply long-lasting vinyl coating protection. Details in Bulletin No. VP-1.
402b *United Chromium.

Electric Furnace Shapes. Information on electric furnace refractories—cores, tubes, muffles—of Alundum or Crystolon materials. Tells how to construct electrical furnaces for laboratory. Bulletin No. 458.
32-3e *Norton Co.

Fabrication, Metal. Manufactures metal products for many industrial uses . . . from complete carbon-black plants to steel conveyor boxes. Designs, engineers and fabricates to specific requirements.
352 *Boardman Co.

* See explanation on p. 444

Fabrication, Plate.....Company is thoroughly experienced in working and welding numerous alloys and clad materials, as well as the carbon steels and stainless steels. For complete details, request Bulletin PF.
298a *Downingtown Iron Wks.

Fabrication, Stainless Steel.....Feature the techniques of fabricating equipment with round corners for efficient service—round corners are stronger... easier to clean. Guide provides complete information.
336a *S. Blickman, Inc.

Insulation.....Carey magnesia insulations defy vibration, humidity, heat. Company's line includes insulation for sub-zero to 2500° F service. Detailed Catalog furnishes complete technical and application data.
322 *Philip Carey Mfg. Co.

Insulation, Cellular Glass.....Covers information on the features and advantages of cellular, "stay-dry" insulation. Valuable booklets describe use of Foamglas to insulate piping, tanks and other equipment.
96 *Pittsburgh Corning Corp.

Insulation, Pipe.....Amosite...the South African asbestos with long, strong, resilient fibers gives Unibestos pipe insulation greater strength and superior insulating ability. Data in Bulletin 109C.
449A Union Asbestos & Rubber Co.

Insulation, Pipe.....Lower heat losses, lower cost with new Snap-On glass fiber pipe insulation. Available in sizes that will fit pipe from 1/4" to 33" nominal diameter, inclusive. Request detailed 8 p. brochure.
103 *Gustin-Bacon Mfg. Co.

Insulation, Refractory-Fiber.....6 p. describes Thermoflex—multi-purpose refractory-fiber felt for service to 2000 F. Covers the "K" factor, sound absorption qualities, chemical & thermal stability, etc.
449B Johns-Manville.

Molding Materials.....Terminal blocks with exceptional strength, both electrical & mechanical, are being molded for U. S. Navy from Cyanamid's new Melmac Molding Material 3135. Product samples & literature.
14-5e *American Cyanamid Co.

Plastics Stamping.....Company makes available an 8 p. pamphlet which describes the techniques of stamping out products from rigid vinyl on conventional metal stamping equipment. Request "Plastics Stamping."
449C B. F. Goodrich Chem. Co.

Refractories.....No other refractory is so chemically stable at such high temperatures under both oxidizing and reducing conditions. Includes fully detailed information on properties in Bulletin No. 1741.
32-5e *Norton Co.

Steels, Alloy.....Announces a new steel which will enable you to improve the performance, lengthen the life, and reduce the cost of industrial equipment. Descriptive Booklet contains the full story of T-1 steel.
93 *U. S. Steel Corp.

Steels, Stainless.....Descriptive 36 p. booklet, "Heat Treating, Forging & Pickling of Armco Stainless Steels," provides complete heat treating information, with valuable reference charts & photomicrographs.
449D Armco Steel Corp.

Steels, Stainless.....Presents 32 p. manual, "Surface Finishing of Armco Stainless Steels." In addition to abrasive polishing there is information on Armco Electropolishing Process, blackening & etching.
449E Armco Steel Corp.

Titanium.....White lustrous metal—dark gray powder—melting point 1727°C—powder ignites 250°C. Features valuable uses: corrosion-resistant materials; electronic getter; scavenger. Details in Bulletin 600.
449F Metal Hydrides.

* See explanation on p. 444

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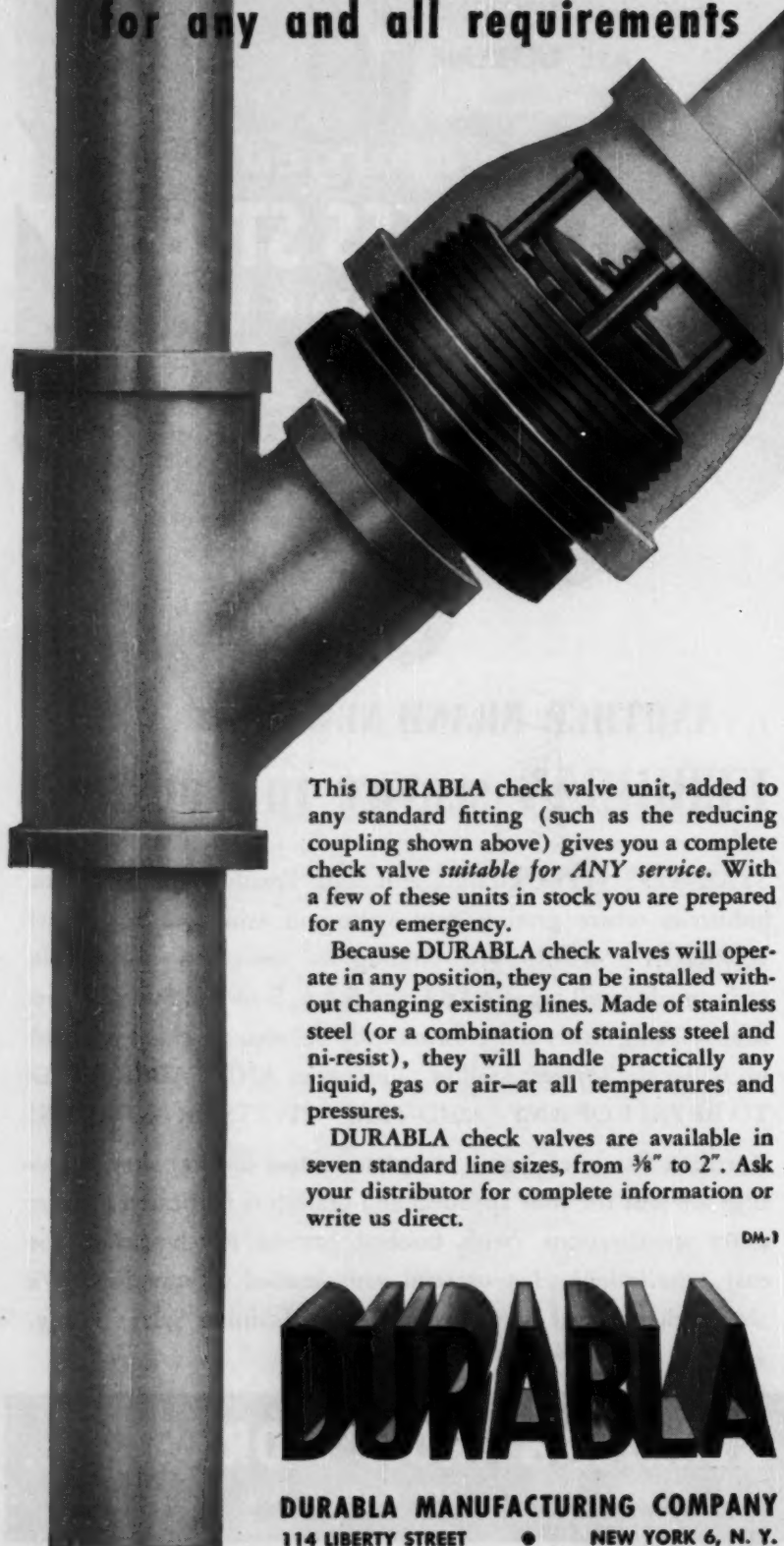
Kerrigan also offers you a complete *custom* service: shop drawings are sent for your approval and grating is fabricated to your exact specifications (with finished grating match-marked for easy installation). Let us send you detailed information. We shall welcome your inquiries on this new Stainless Steel Grating.

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LITERATURE . . .

Electrical & Mechanical

Belts, V-..... Links are quickly joined by easy-to-use cup-washers & T-screws to make up individual belts. Easiest V-belt to couple & uncouple. Lasts longer—more flexible. Offers new 8 p. illustrated Catalog.
307 *Manheim Mfg. & Belting Co.

Cables..... Illustrated, 36 p. on rubber-insulated Loxarmor cable constructions, a cost-saving cable design for use in racks or trays for applications where rigid conduit systems are unnecessary. Bulletin 1090.
450A Okonite Co.

Drives..... Illustrated, 32 p. describes parallel shaft gear drives. Lists 39 standard size drives for efficient vibration-free transfer of power, together with line of baseplates & built-in backstops. Book 2619.
450B Link-Belt Co.

Drives, Motor..... Power Transmitters used extensively on machine tools, textile machinery, winding & spooling equipment, conveyors, etc., where repeated starting and stopping is required. Bulletin CE-3303.
139 *Diehl Mfg. Co.

Fixtures, Explosion-Proof..... Standardized Unilet body permits 53 second interchange of 60 watt to 500 watt fixtures... saves time, prevents shutdowns. Bulletin provides full details on AA-51 Series.
261 *Appleton Elec. Co.

Gaskets, Teflon-Jacketed..... Includes pertinent information on corrosion-resistant teflon-jacketed gaskets for glass-lined steel connections. Corning conical flanges, etc. in illustrated Catalog No. TG-953.
351a *U. S. Gasket Co.

Gearing..... Complete data on Dutil-Rated Lifetime gearing. Besides illustrating & listing line, with full specifications, book offers material helpful in selection of proper gear sets. Engrg. Manual Dr. No. 2.
450C Foote Bros. Gear & Mach.

Generating Plants, Electric..... New emergency plants of 75,000 watt capacity specially designed to meet electrical requirements of hospitals, hotels, chemical plants, food processing plants, etc. Illustrated.
450D D. W. Onan & Sons.

Motor Units..... Chapman's simple and rugged motor unit gives accurate trouble-free control of large valves and sluice gates. Operates smoothly under the most adverse conditions. Details in new Catalog No. 51.
288 *Chapman Valve Mfg. Co.

Motors..... As a companion to its line of Type M Unibrake motors with magnetic braking... company now offers a line of Type D Unibrake motors with dynamic braking. Provides complete information—Data 3810.
483 *Master Elec. Co.

Motors..... Illustrated, 12 p. describes new Super "T" Line D-c motors with Dynamic Response. Includes data on speed ranges, acceleration rates, enclosures, dimensions, selection, etc. Request Bulletin C-2002.
450E Reliance Elec. & Engrg. Co.

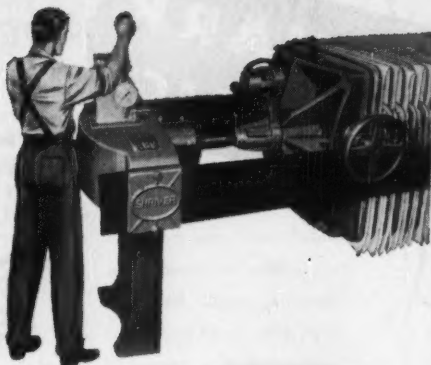
Motors & Controls..... New engineering literature on application of a-c motors & controls to centrifugal compressors. Included in reference are diagrams, charts, graphs, illustrations, etc. Publication No. 1120.
450F Electric Machy. Mfg. Co.

Motors, Totally-Enclosed..... For dirty or corrosive location or for outdoor operation in all kinds of weather. Available in ratings on frames larger than NEMA 505 up to 3000 horsepower. Data in Bulletin 51B7149.
141 *Allis-Chalmers Mfg. Co.

* See explanation on p. 444

Install HYDRO-KLOSERS

on Your
Filter Presses
and **SAVE**



The Hydro-Kloser is a low cost, compact, rugged hydraulic closing device that eliminates time loss and hard labor inherent in manual closing of filter presses. A few easy strokes of the hand lever on the pump bring the pressure to complete tightness of the filter press. This takes but two to three minutes. Opening the press is just as speedy.

The more uniform, more powerful thrust of the Hydro-Kloser assures better closure; minimizes leakage difficulties; saves time per filtration cycle.

It pays to be safe and to save with Hydro-Klosers. Get the full story. Write for bulletin.

This low cost closing unit, easily installed on existing Shriver and other make filter presses, consists of a simple hydraulic ram operated by a small, sturdy hydraulic pump. The ram assembly is mounted on the inside face of the screw standard, replacing the regular screw bushing. Standby manual closing is always available.

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The editors have been snowed under with comments, compliments, criticisms . . . Reader Service requests will hit 60,000 before the next issue's out . . . and thanks to you, we're getting plenty of new ideas for the 1955 edition.

Keep 'em coming . . . but hurry! Publishing date's October . . . and we want all the help we can get to make this year's *Inventory Issue* better'n ever.

**ANNUAL
INVENTORY
ISSUE**

Chemical  
Engineering

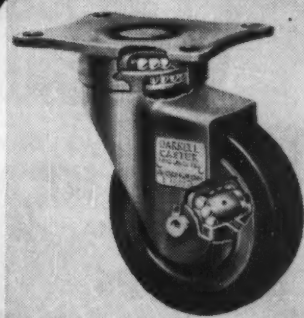
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CHEMICAL ENGINEERING—May 1955

DARNELL

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for the chemical industry



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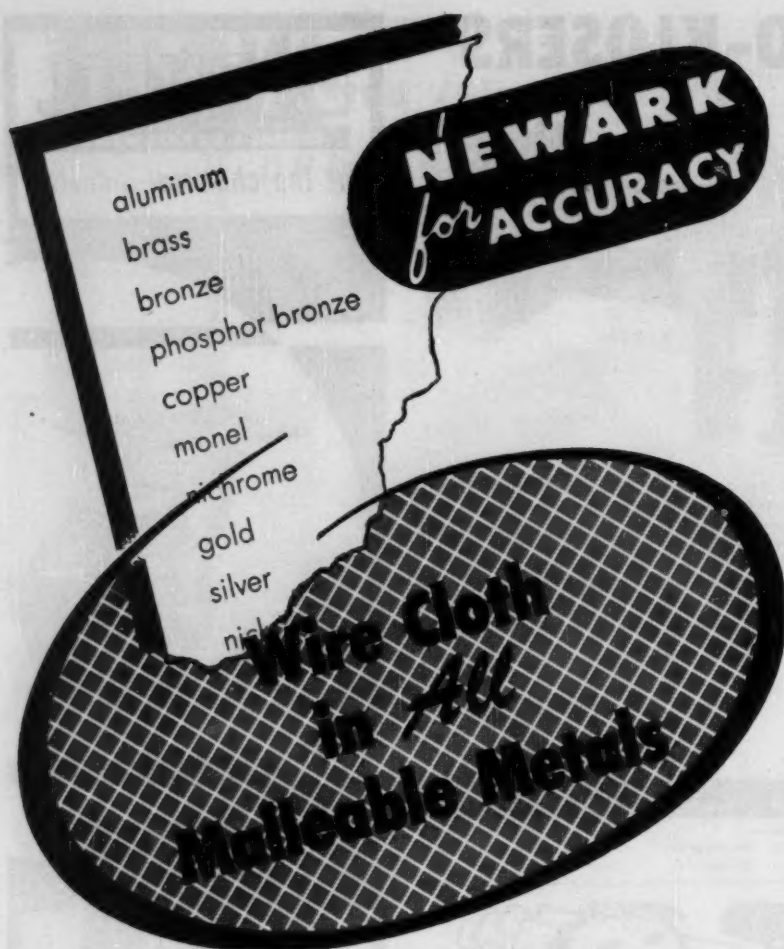
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LITERATURE . . .

Seals, Mechanical. For pumps, agitators, autoclaves and similar processing equipment. Furnishes the complete story of new line of Chempro "wedge-lock" mechanical seals in illustrated Bulletin No. CP551.
360 *Chemical & Power Products.

Seals, Mechanical. Combining chemically impervious teflon with a balanced bellows design—Chemiseal external mechanical seals last longer & give unsurpassed performance. Details in Bulletin No. MS-954.
362 *U. S. Gasket Co.

Seals, Mechanical, Rotary. Company announces the availability of a new 8 p. reference which shows how you get maintenance-free sealing that slashes fluid mixing cost to a new low. Illustrated Bulletin B-111.
125a *Mixing Equipment Co.

Starters, Solenoid. Explosion-proof solenoid starters . . . for safe, automatic motor operation in hazardous locations. Request Handy Catalog, a guide for selection of motor controls & enclosures.
404 *Allen-Bradley Co.

Transformers. Fully illustrated, 100 p. contains ratings, ASA accuracy classifications, and prices of all Standard G-E indoor and outdoor potential and current transformers. Request Bulletin No. GEC-1028.
452A General Elec. Co.

Transformers, Substation. Wagner "predesigned" standard unit substation transformers are carefully engineered to meet heavy industrial demands. For complete information, request Bulletin No. TU-205.
280 *Wagner Elec. Corp.

Turbine-Generators. Rated from 2500 kw to 40,000 kw—for electric utilities & industrial plants condensing & non-condensing applications. Cross-sections, drawings, photos, etc. in 56 p. Bulletin GEA-3277C.
452B General Elec. Co.

Turbines, Steam. Turbines range from 150 horsepower down to fractional in 6 frame sizes. Feature large number of manually operated valves for individual control of steam nozzles. Details in Bulletin 135.
156 *Coppus Engrg. Corp.

Turbines, Steam. Issues new literature on line of single-stage steam turbines with steel casing construction. Cutaway view of a typical unit is shown describing the standard features. 8 p. Bulletin 1954C.
452C Worthington Corp.

Handling & Packaging

Conveying Systems. Select and apply right system for conveying dry, pulverized and granular materials efficiently and economically. Illustrates and describes four conveying systems in Bulletin No. G-1.
84 *Fuller Co.

Conveyors. Handle packages, parts, units—faster—at reduced cost with gravity or power roller, belt, slat, chain, wheel or push-bar conveyors. Specifications, drawing & application data in General Catalog.
464 *Sandard Conveyor Co.

Conveyors. New Conveyor Catalog describes and illustrates portable stacking conveyors, floor to floor conveyors, horizontal belt conveyors, gravity roller conveyors, and gravity wheel conveyors.
452D Samuel Olson Mfg. Co.

Feeders, Constant Weight. Jeffrey-Traylor "Waytrol" constant weight feeder provides guaranteed accuracy within plus or minus one percent when belt speed is constant. Complete information upon request.
406a Jeffrey Mfg. Co.

* See explanation on p. 444

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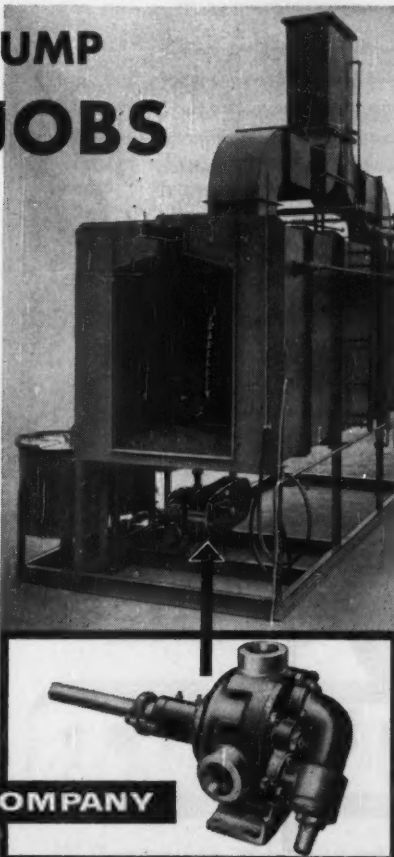
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Viking pumps used on the flow coat machines built by Erikson Mfg. Co. of El Monte, California serve a multi-purpose. Due to the reversing feature of Vikings, a single pump is used to supply paint to the machine and, when reversed, is a fast cleaning pump.


Another outstanding feature of this Viking pump is the variable speed and capacity change. This readily permits regulating rate of flow for painting different size parts.

Whatever your pumping problem for handling thick or thin liquids, ask Viking for the answer. Start today. Ask for folder 55Sc.



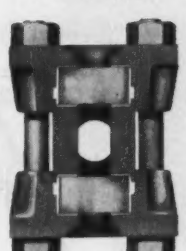

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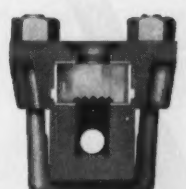


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CHEMICAL ENGINEERING—May 1955

453

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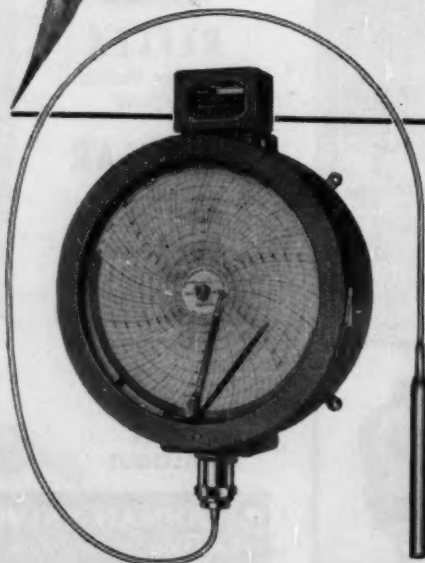
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LITERATURE . . .

Handling & Storage, Bulk Chemicals. . . . New 24 p. reference, "Chemicals—Handling and Storage," describes and illustrates Sauerman storage machines in use at a variety of installations. Booklet MMM No. 2. 454A Sauerman Bros.

Packaging, Butyrate Peelable Plastic. . . . 12 p. outlines application of Eastman's butyrate peelable plastic in hot melt dipping of various parts used by automotive & aviation industries, machine shops, etc. 454B Eastman Chem. Products.

Pulleys, Magnetic. . . . Now offers a powerful new electro-magnetic pulley that provides exceptional tramp iron removal throughout the entire load mass. Features advantages of 2-coil design. Data in Bulletin 303-C. 76 *Stearns Magnetic.

Scales. . . . Right on your conveyor line, Exact Weight scale gives an accurate check in seconds of both open-end & valve-type bags. Because every bag is checked, over-weights can be eliminated. Complete details. TL361 *Exact Weight Scale Co.

Separators, Magnetic. . . . Ferrofilters remove contaminating ferrous particles from liquids and slurries by magnetic action with a maximum of efficiency and a minimum of cost. Request detailed Bulletin 16-E. R470 *S. G. Frantz Co.

Silos, Storage. . . . Give valuable materials the protection they deserve in moisture-free, fire-safe, adaptable concrete stave silo storage systems. For complete details, request your copy of silo storage catalog. 454C Marietta Concrete Corp.

Tanks. . . . Construction, dimensions, specifications & prices given for bolted steel tanks, bolted steel thickener tanks, bolted steel tray tanks, welded steel tanks & wood tanks, in 16 p. illustrated Bulletin T2-B5. 454D Denver Equipment Co.

Tanks, Bulk Storage. . . . For storage of solvents, resins, alcohol, petroleum & chemical products. New booklet contains essential information including available stock sizes, capacities, weights, dimensions, etc. 454E Graver Tank & Mfg. Co.

Tractor-Shovels. . . . Payloader line features full-reversing transmissions plus torque converter drive . . . for maneuvering speed, ease of control and a wide choice of operating ranges. Complete information. 311 *Frank G. Hough Co.

Trucks, Platform. . . . Equipment and Development Release made available describing company's 7500 pound capacity Worksaver Lowlift platform truck. Includes full specifications and dimensions. Release ED-25. 454F Yale & Towne Mfg. Co.

Heating & Cooling

Coolers, Cascade. . . . Designed for cooling corrosive liquids and gases. Low initial cost and maintenance, radlused returns for low pressure drop as well as redwood waterguide strips. Request Catalog No. S-5820. 247e *National Carbon Co.

Heat Exchangers. . . . Describes line in a series of 12 informative advertisements featured in various publications. Covers company's history, facilities, research program, engineering department, etc. 454G Western Supply Co.

Heat Exchangers. . . . Illustrated, 12 p. describes the "Holo-Flite" Processor—a proven heat exchanger for cooling, heating, cooking & drying. Covers many features, construction & operation, applications, etc. 454H Western Precipitation Corp.

* See explanation on p. 444

Heat Exchangers.....Describes how equipment offers: chemical resistance to practically all corrosive fluids; resistance to severe thermal shock; high heat-transfer rates; low maintenance; etc. Catalog S-6740. 247c *National Carbon Co.

Heat Exchangers....."SU" is an instantaneous type, designed to heat liquids with steam. Lists ratings for most commonly required temperature rises thru a wide range of steam pressures in Catalog GN-1054. 455A Bell & Gossett Co.

Heat Exchangers, Tube Bundle.....New standardized heat exchanger design features lower first cost, more area per unit, choice of tube lengths, faster delivery, etc. Company offers full details in Catalog S-6840. 247d *National Carbon Co.

Heat Transfer & Crystallization.....Offers descriptive literature—a 52 p. book giving practical presentation of the fundamentals of modern evaporation & crystallization methods & equipment. Bulletin No. E-106. 1351 *Swenson Evaporator Co.

Heaters, Gradation.....Selas Gradation Zone Control offers new possibilities in every chemical plant where heat processing is a precise operation. Provides complete information in a new 16 p. Booklet. 302 *Selas Corp. of America.

Heating Units, Electric.....Literature describes methods of electrically heating liquids, air, gases, machine parts, process equipment. Illustrated 32 p. booklet, "101 Ways to Apply Electric Heat," No. F1550. 157 *Edwin L. Wiegand Co.

Platecoils.....Designed for tank heating and cooling problems due to inefficient pipe coils. These cost-saving platecoils heat or cool 50% faster and take 50% less space in the tank. Offers Bulletin No. P61. 308 *Tranter Mfg.

Towers, Cooling.....New catalog illustrates and explains in clear detail the construction and operation of Acme towers in the capacity range of 15 through 100 tons. Covers outstanding features. Catalog No. 700. 455B Acme Industries.

Towers, Cooling....."Packaged Cooling Tower Know How" includes flow charts, wiring diagrams, pump selection, etc. It deals with both mechanical & natural draft cooling towers & method of selection of both types. 455C Marley Co.

Tubes, Condenser & Heat Exchanger.....Steel and Tubes Division has published new literature describing line of carbon steel tubing for heat exchangers and condensers. Illustrated 12 p. Brochure No. HEC-1. 455D Republic Steel Corp.

Tubes, Heat Exchanger.....Chase Antimonial Admiralty heat exchanger tubes contain the right amount of antimony needed to resist dezincification & other forms of corrosion. Condenser & Heat Exchanger Tube Booklet. 310 *Chase Brass & Copper Co.

Instruments & Controls

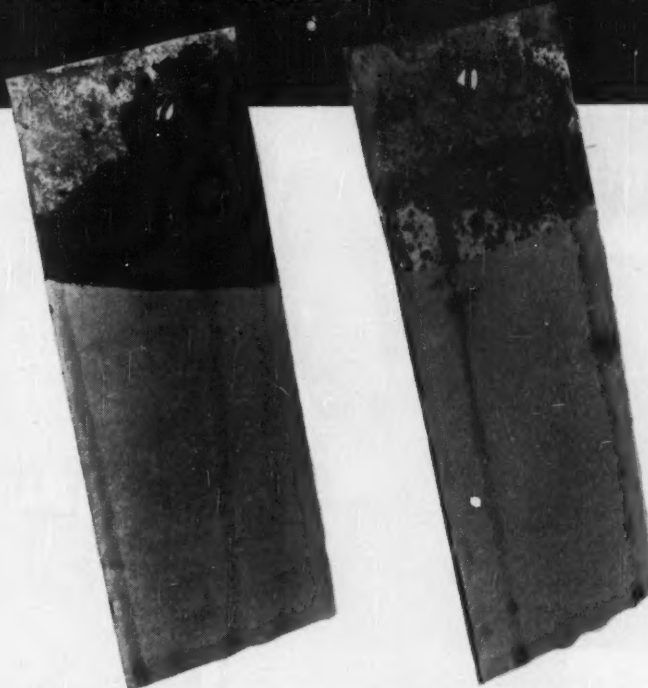
Comparators.....Fully illustrated, 100 p. tells how to use pH and chlorine control for water supplies, process solutions, production processes in 34 basic industries. Also covers complete line of comparators. R363 *W. A. Taylor & Co.

Control, Dew Point.....In successful use in nuclear fission, pharmaceutical, food and chemical plants, distilleries, photo film production, drying and storage operations. For full data request Bulletin No. 407. 69 *Foxboro Co.

* See explanation on p. 444

CHEMICAL ENGINEERING—May 1955

TESTS PROVE **NEW** EASY-TO-APPLY **RUSTBOND PRIMER #6** LENGTHENS **ANY** TOPCOAT LIFE



These test panels of rusty steel were coated at the same film thickness and exposed side by side in a highly corrosive atmosphere (35% hydrochloric acid vapors) for the same length of time. Coatings on both panels were identical, with one exception: primer on left panel was new Rustbond #6, that on right was a popular competitive primer. In both cases, the topcoat was the same *well known competitive brand*.

As this unretouched photo shows, the sharp edge protection of the panel at right has completely failed, while the panel primed with Rustbond #6 shows practically no edge failure.

You can get improved performance like this from *any* topcoat—vinyl, phenolic, alkyd—with Rustbond #6 as the primer.

Rustbond #6 offers you these advantages:

- Dries in only 10 minutes at 85°F., 15 minutes at 70°F., reducing application time and cost.
- Can be applied over wirebrushed rusty steel or bright shiny steel.
- All-purpose primer, especially resistant to acids and alkalis.
- Excellent shop coat because of easy application and high resistance to weathering.
- Can be brushed, sprayed, hot sprayed or roller-coated without webbing.

TRY IT YOURSELF

We will furnish a free sample of Rustbond Primer #6 for your own similar testing. Advise atmosphere, type of surface and topcoat involved. Write today.

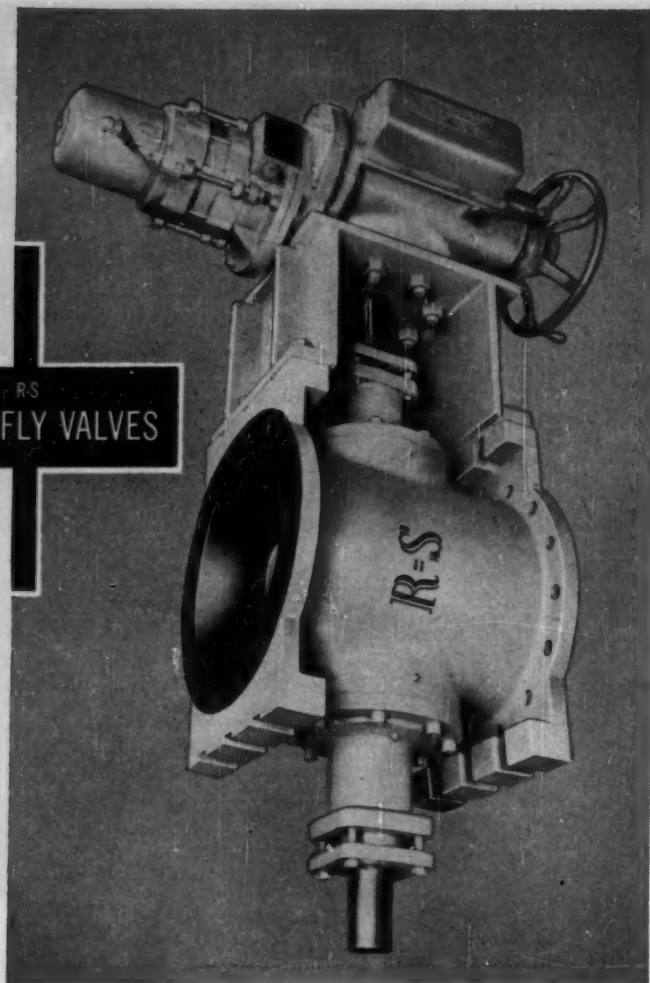
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Where rugged processing conditions call for special handling, R-S Butterfly Valves are designed and built to meet individual requirements. Any type of metal or other material that can be cast or welded—even plastics—may be specified for valve bodies or parts.

Special metals have been developed to withstand corrosion, abrasion, erosion, high heat and pressure. For certain types of corrosion, the R-S Rubber-lined Valve may be used. Every R-S Valve gives you the advantages of quick and positive closure with any type of controls, uniform control in normal regulating range, and minimum pressure drop to save power.

If your own past experience offers no precedent, we offer the broad background in specialized valve engineering to assist in solving material problems. For complete information on our full line of butterfly, cone and ball valves, see our local representative or write to S. Morgan Smith Company, York, Pennsylvania.

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LITERATURE . . .

Controllers, Indicating.....Series 540 "On-off" indicating controller . . . is a rugged, durable & accurate remote indicating temperature control instrument designed for general industrial use. Illustrated Bulletin MC 122.
86a *Fenwal, Inc.

Controllers, Indicating.....Offers data on new Series 560 controller . . . with revolutionary thermistor principle of operation for kilns, ovens, furnaces, extruding, air heaters, etc. Features & specifications. Bulletin MC123.
86b *Fenwal, Inc.

Controls, Level.....Tektor level control indicates or controls level of fluids, powders, solids (conducting or non-conducting). Features low first cost . . . low operating cost. Request descriptive Bulletin.
337a *Fielden Instrument Div.

Controls Sizing.....BS&B's new, exclusive method takes both the "guess" and the "work" out of controls sizing for liquid, steam and gas applications. For complete information, request company's new Manual.
456A Black, Sivalls & Bryson.

Controls, Supervisory.....Describes accurate digital supervisory control expressly designed for remote measurement & such control functions as remote shaft positioning, on-off switching, etc. Bulletin ES-1.
456B Bendix Aviation Corp.

Converters, Differential.....Complete information on company line in Bulletin No. 2291, "Differential Converter Liquid Level Transmitter," and Bulletin No. 1160, "Measuring and Controlling Liquid Level."
52-3 *Minneapolis-Honeywell.

Counters.....Complete line of electrically & mechanically actuated counters for indicating, recording & automatic regulation of industrial machinery described in Illustrated Technical Reference No. 54C.
456C Richardson Scale Co.

Gages.....For pressure, vacuum or compound service. There are no gears or teeth to wear out. Cam wiping action keeps contact points clean & smooth. Provides complete information in Gage Catalog No. G-2.
341 *Helicoid Gage Div.

Gages, Liquid Level.....Completely illustrated 76 p. reference describes the entire line of Penberthy liquid level and water gages . . . and also indicates their numerous points of superiority. Request Catalog 35.
378 *Penberthy Injector Co.

Indicators, Dew Point.....Read dew points instantly . . . accurately. Dew-point is completely self-contained, requires no external coolant or auxiliary apparatus. Operates on either a.c. or enclosed battery. Illustrated.
R365 *Illinois Testing Labs.

Indicators, Sight Glass.....Visi-Flo line offers a trustworthy visible means of alerting you as to rate of flow, viscosity, color of liquids, clarity & purity of product. Sizes, styles, details in Bulletin No. F-6.
20 *OPW Corp.

Instruments, Metagraphic.....Measure, record, indicate & automatically control: pressure, vacuum, absolute pressure, differential pressure, liquid level, flow, temperature & mechanical motion. Product Data Sheets.
44-7 *Bristol Co.

Meters.....Company's line now handles more than 150 different industrial liquids. Sizes from 25 to 1000 gpm. Bronze construction. For complete information, request the helpful Meter Selection Book No. 566S.
456D Neptune Meter Co.

Meters, Continuous Weighing.....Pneumatic balance meters with Brown receivers provide accurate, continuous solids flow and weight measurements. Includes design and method of operation in Data Sheet No. 11.5-3.
456E Minneapolis-Honeywell.

* See explanation on p. 444

SLY PIONEERS and LEADERS

in INDUSTRIAL DUST CONTROL

Proportioning, Automatic..... Furnishes information on Richardson's automatic proportioning systems. Includes complete case history file of Select-O-Weigh installations in industry. Illustrated 28 p. Bulletin 0351.
48 *Richardson Scale Co.

Readers, Direct..... New features of 1955 direct readers give improved optical stability, more precise monitoring & increased flexibility in spectrum line selection. Find complete information in Bulletin No. 34-C.
457A Baird Associates.

Recorders..... Offer valuable features: pre-calibrated plug-in receiver units; up to 4 pneumatic or electronic receivers—or 2 receivers & 2 integrators; etc. Product specification E12-5 available on request.
24 *Bailey Meter Co.

Recorders, Laboratory..... Illustrated, 12 p. furnishes facts-and-figures on new laboratory recorder that converts manual laboratory instruments into automatic, recording instruments. Bulletin No. FS-251.
457B Fisher Scientific Co.

Regulators, Automatic Voltage..... Feature: 115, 230 & 460 volt ratings for single & 3 phase duty in capacities up to 100 KVA; zero waveform distortion; etc. Complete information in Bulletin No. S351.
65 *Superior Elec. Co.

Regulators, Pressure..... Describes the Series 95 self-contained pressure regulator... a simple, sturdy regulator suitable for steam, air, gas, oil, water and other fluids. Details in Bulletin No. C-95.
457C Fisher Governor Co.

Spectrographs..... Baird Associates model 3-M Spectrograph, the first large grating instrument to be used commercially, offers many new refinements which increase its effectiveness. Details in Bulletin 32-C.
457D Baird Associates.

Spectrometers, Mass..... Two companion instruments, Types 21-610 & 21-620, now extend the speed & accuracy of mass spectrometric analysis from the laboratory out into the plant. Bulletin No. CEC-1824A-X16.
355 *Consolidated Engrg. Corp.

Transmitters, Pneumatic..... 36 p. reference covers transmitters for measuring flow, pressure, level or density. Describes & illustrates 22 different models, gives hook-ups, ranges, performance data. Data Book 1004.
457E Republic Flow Meters Co.

Pipe, Fittings, Valves

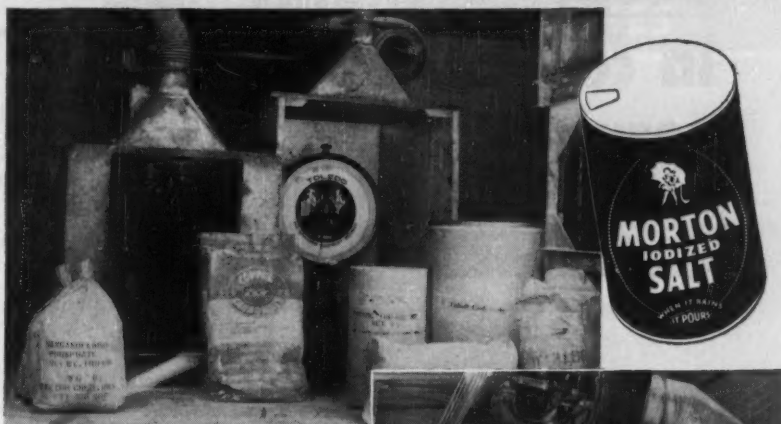
Couplings..... Steelflex couplings offer unique multiple protection for connected machinery—overcome damaging conditions of shock loads, shaft misalignment and vibration. Engineering Bulletin covers details.
82 *Falk Corp.

Fittings, Pipe..... Presents newest catalogue of stainless steel pipe fittings which shows all standard pipe fittings and flanges, flanged fittings, butt weld fittings, etc. Request illustrated Catalog 653.
353a *Camco Products.

Fittings, Socket-Welding..... In high pressure steam lines—process liquid & gas piping—hydraulic fluid lines... company's fittings provide a safety factor against costly piping failures. Request Catalogs.
293 *Watson-Stillman Fittings.

Fittings, Stainless Steel..... Three good reasons for purchasing Cooper Alloy stainless steel fittings—availability (quick—when you need it)... superior quality... complete line. Fitting Catalog 52F.
299 *Cooper Alloy Corp.

* See explanation on p. 444



Sly Unit Dust Filter at Rittman (O.) Plant.

Hooded enclosures at dust source, connected by ducts to the Sly Dust Filter.

IF IT'S DUST IT'S SLY



If your processing involves dust, what the Morton Salt Co. has accomplished will be of interest to you.

Three years ago at one of its mills, this company had a serious dust problem—and installed a Sly Unit Filter. The equipment has proved entirely satisfactory in cleaning up the plant and improving its appearance.

Since then the Morton Salt Co. has made Sly installations at five other plants—not only Unit Filters but also the larger standard Filters including the Sly Dynaclone. These Filters are handling salt and similar dusts from conveying, screening, blending, and packaging operations.

In industries where collected dust is high in value, such as pigments, metallic and non-metallic minerals, Sly Dust Control not only cleans up the plant but also saves thousands of dollars yearly in value of collected dust.

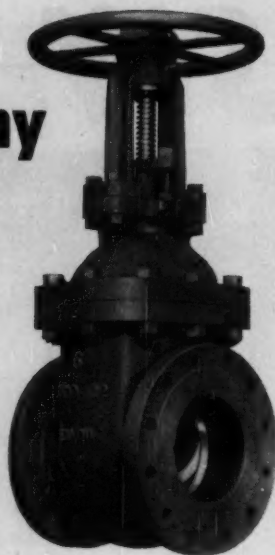
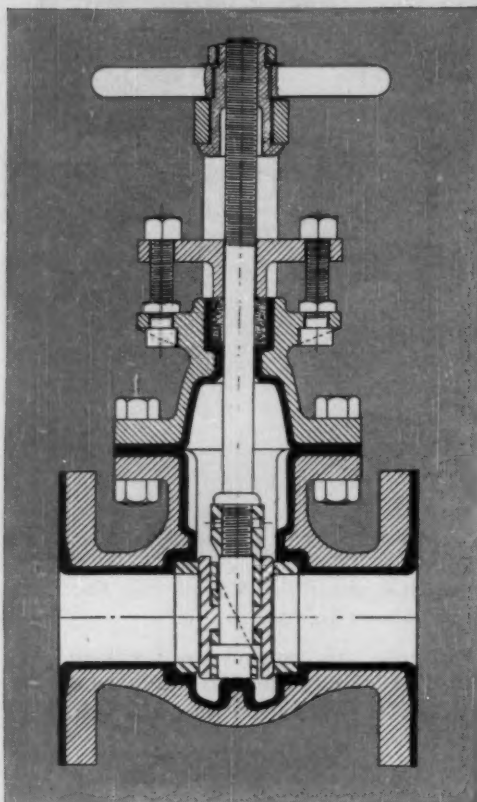
Regardless of what you make, if you have a dust problem, our long experience in collecting all kinds of dusts can be of value to you in cleaning up the plant and effecting savings—which frequently repay, in a relatively short time, the cost of the equipment.

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FOR double economy in corrosive service



• Darling rubber-lined iron body gate valves, with special alloy working parts, offer trouble-free corrosive service and big savings. Available in rising stem, cylinder or motor operated, or quick-opening types.

HERE'S a Darling gate valve that can save you plenty of dollars in corrosive services up to 180° F. This is an iron body valve with a hard rubber lining permanently bonded to all exposed interior surfaces, and suitable for working pressures up to 150 pounds.

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LITERATURE . . .

Fittings, Tube.....Announces Parker Weld-lok tube fittings . . . machined from high-quality steel or stainless steel bar stock and forgings . . . for tubing 1/4 thru 2 in. O.D. Offers new Catalog 4370.
458A Parker Appliance Co.

Flange Specifications.....Company announces the development of a new Flange Specification table for ASA and MMS Flanges in a convenient, slide rule form. Pocket-size reference is available upon request.
353b Camco Products.

Hangers, Pipe.....With the Blaw-Knox functional spring hanger, you can readily control both lateral & longitudinal swing movements of hanger rod up to 7 degrees. Contains full information in Bulletin No. 54.
354 Blaw-Knox Co.

Hose, Metal, Flexible.....Manufacturer furnishes a complete description of varied applications for flexible metal hose and tubing . . . including fittings. Shows how tubing is designed, used, installed. 16 p.
227a American Brass Co.

Joints, Expansion.....There's a Garlock expansion joint for your piping applications . . . to stop vibration, flange breakage—to relieve stresses and strains in piping and equipment. Expansion Joint Folder AD-137.
439 Garlock Packing Co.

Nozzles, Spray.....Company provides a 48 p. industrial catalog with full data on thousands of standard and special nozzles—for every type of spraying. Also information on related equipment. Catalog No. 24.
TR369 Spraying Systems Co.

Nozzles, Spray.....Reach a new peak in spraying efficiency . . . with Yarway non-clog nozzles. Reference includes capacities, dimensions, application information, etc. Request Spray Nozzle Book No. N-617.
269 Yarnall-Waring Co.

Pipe & Fittings.....For corrosion-resistant piping. Impervious graphite pipe & fittings readily installed, long lasting, easily maintained, unaffected by most corrosive fluids. Request Catalog No. S-7000.
247b National Carbon Co.

Pipe & Fittings, Glass.....Pyrex brand "Double-Tough" glass pipe can help cut corrosion losses. Catalog covers full line of pipe & fittings, including spacers, adjustable joints, traps, & adapter connections.
387a Corning Glass Wks.

Pipe & Fittings, Polyvinyl Chloride.....Furnishes details on 1/2" to 4" line of normal impact & high impact unplasticized polyvinyl chloride pipe & fittings, plus properties & characteristics data, etc.
BR369 Alpha Plastics.

Pipe Installation, Glass.....Company makes available upon request an illustrated "Installation Manual," which describes the simple procedures involved in laying out and plumbing Pyrex brand glass pipe.
387b Corning Glass Wks.

Tubes, Dall Flow.....Reduce meter head loss where it counts . . . at the pipe line. Feature compactness and economy. For complete information on the numerous advantages, request illustrated Bulletin No. 115-L1.
458B Builders-Providence.

Tubes, Flow.....Gentle flow tube measures flow in either direction. Provides detailed information on the numerous features—reversibility . . . low installed cost . . . accuracy . . . lowest head loss. Request Bulletin No. FT-101.
TL 365 Foster Engrg Co.

Valves.....For corrosive liquor services of the pulp and paper industry. Includes data on the numerous features, general dimensions, a trim and pressure rating chart, etc., in 4 p. illustrated Form 1000.
458C Ohio Injector Co.

* See explanation on p. 444

New Type Eppenbach COLLOID MILL

Featuring

Large Tangential Outlet which prevents back pressure and allows increased output capacity
Both Rotor and Stator are Interchangeable
Stellite rings and stones—facilitating replacement when required.

Sanitary fittings throughout.
Illustration shows large production Mill Model QV-11 with 15 H.P. motor

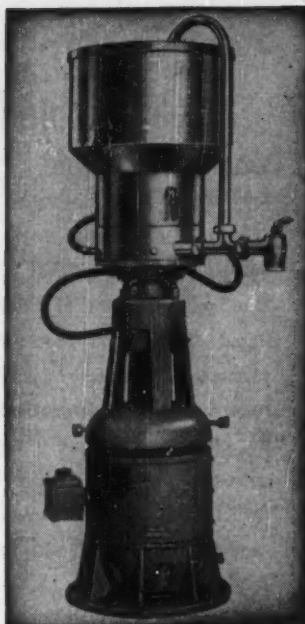
Eppenbach Colloid Mills operate at speeds approaching the theoretical minimum required for true wet micro grinding—shaft speeds up to 10,000 r.p.m. depending on size and type of mill.

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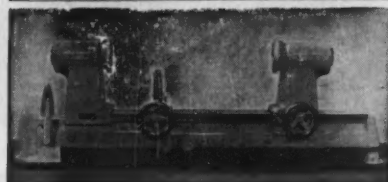
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Variable speed pulley assembly
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That simple chucking attachments supply versatility for wide varieties of applications?

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2. Control Pumps, Valves, etc.

WITH AUTO-SWITCH METERS

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Ask for Helpful Metering Bulletin 567A

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LITERATURE . . .

Valves Another famous Hammel-Dahl first—new, patented reversible superstructure. Feature tremendous saving of reversal time (only 7 minutes required) . . . consolidation of spare parts. Bulletin 109-B. 257 •Hammel-Dahl Co.

Valves Describes the new type "M" valves . . . for the toughest service—for hot, concentrated sulfuric acid and other corrosives too severe for the stainless alloys. Full information in Bulletin V/8. 27 •Duriron Co.

Valves New Crane corrosion-resistant valves in 18-8 SMO and Craneloy 20 . . . gate, globe and angle patterns. Both lines come with screwed or flanged ends. Full information given in Circular AD 2059. 249 •Crane Co.

Valves OIC valves for the L-P gas industry provide a safe, absolute seal and extra-long service. Includes features, applications, dimensions, typical installations, etc., in illustrated Form 1002. 460A Ohio Injector Co.

Valves, Bronze Seat & disc are super-hard "500 Brinell" stainless steel, formed for tight bottom seating under compression, without tension. No leaks—no wire drawing, galling, steam cutting. Bulletin 260. 94 •Manning, Maxwell & Moore.

Valves, Check Illustrated, 8 p. fully describes line of double cushioned electric check valves. Includes dimensions, cross-sectional views with parts list, suggested wiring diagrams, etc. Bulletin W-10. 460B Golden-Anderson Valve.

Valves, Gate, Bronze Announces release of a new descriptive Folder describing 40 patterns in complete line of bronze Gates. You will find the valve you need, with details of design and construction. 271 •Jenkins Bros.

Valves, Globe Design and construction of valves dictated solely by the requirements for the handling of chemicals. Ruggedness, quality and low maintenance costs featured. Illustrated Bulletin No. H-2. 460C LaBour Co.

Valves, Lubricated Plug Cover variety of services for gasoline, oil, water, air, gas, acids, chemicals, etc. Includes characteristics of design, special features & types, in 44 p. illustrated Catalog No. 5. 283 •ACF Industries.

Valves, Lubricated Plug Gland liner . . . versatile component of newly designed OIC line . . . seals, reduces friction, helps extend packing life. Full data on lubricated plug valve design in Bulletin 1003. 392 •Ohio Injector Co.

Valves, Porcelain Company makes available detailed literature covering the features and advantages of porcelain valves. Bulletin includes complete description, characteristics and specifications. 241 Lapp Insulator Co.

Valves, Pressure Reducing Automatically maintain a constant reduced pressure of steam, air or gas. Single seated, tight closing. Respond instantly to load changes. Complete information in Bulletin 5302. 324 •Leslie Co.

* See explanation on p. 444

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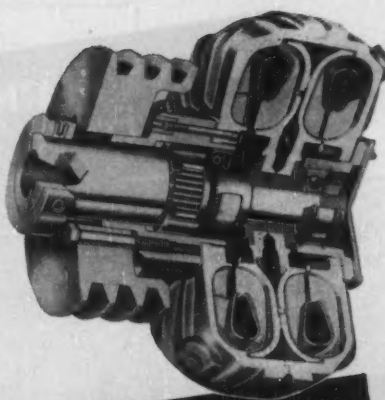
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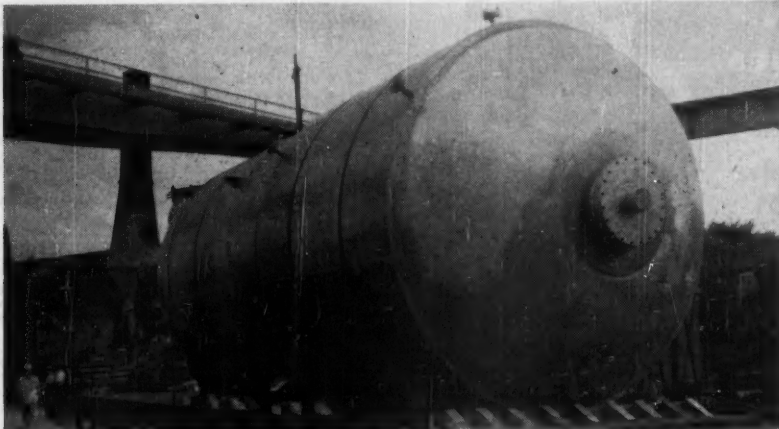


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That's why fluid drive eliminates motor burn-outs and engine lugging, improves distribution of loads on compounded drives, and permits selection of motors on basis of running requirements rather than starting requirements.

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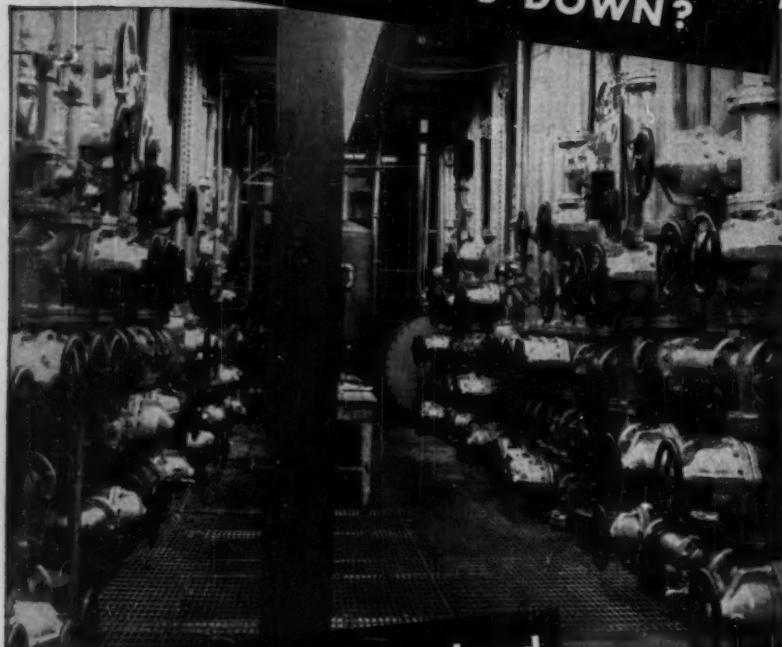
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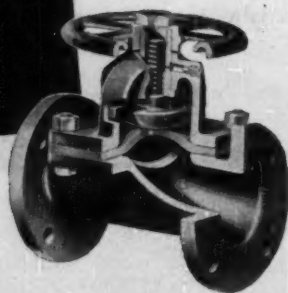


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The problem was solved
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The unique Saunders Patent design of Hills-McCanna Diaphragm Valves completely isolates the working parts of the valve from the flow. There is no packing to tighten or replace . . . no problem of leakage, internally or externally. You have a choice of body materials of any machinable alloy or linings of lead, glass, rubber, plastic, etc. Fifteen diaphragm materials are available including rubber, Neoprene and Teflon. There is also a wide choice of manual or remote operators. Sizes range from $\frac{3}{8}$ " through 14". May be used at pressures to 150 psi, temperatures to 350° F.

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Magnesium Alloy Sand Castings

LITERATURE . . .

Valves, Water-Steam Mixing Cannot discharge live steam should water pressure fall. Ideal for processing, washing and other applications. Describes operational features in illustrated, 4 p. Bulletin.
462A Hammel-Dahl Co.

Process Equipment

Absorbers For absorption of hydrogen chloride and other gases. Produce as much as 20 tons per day 22" Baume acid. Pneumatic automatic control. Complete information offered in Catalog No. S-7460.
247f *National Carbon Co.

Agitators Especially designed to prevent short circuiting and to create maximum, air-bubble dispersion. Center or side airlift types generally used in cyanide work. For full details, refer to Bulletin A2-B4.
462B Denver Equipment Co.

Blenders, Dry Batch Company's line of dry batch blenders . . . are the answer to fast, economical mixing. For complete information about the numerous features and advantages, request illustrated Bulletin.
355a *Sturtevant Mill Co.

Centrifuges High speed dehydrating centrifuge offers precise external control of variations in flow rate, crystal size & slurry concentration & permits intermediate treatment of crystals. Bulletin No. 1257.
123 *Sharples Corp.

Cloth, Filter Information on CPS, the "controlled-pore size" filter cloth of teflon for corrosive liquid and gas filtration compiled in a new reference. Request copy of CPS Teflon Cloth Bulletin T-112.
462C Porous Plastic Filter Co.

Cloth, Filter "Facts & Figures About Filter Cloth" contains actual samples & performance characteristics on Stanley corrosion-resistant filter cloths. Also folder on centrifugal bags & filters.
TL461 *W. W. Stanley Co.

Columns, Glassed Steel For extra corrosion-resistance . . . for process flexibility. Rated for full vacuum and internal pressure starting at 25 psig. Furnishes complete information in Bulletin No. 907.
464a *Pfaudler Co.

Crushers, Jaw Illustrated, 24 p. booklet offers complete information on company's line of jaw crushers. Built in eight sizes with capacities up to 300 tons per hour. Details available in Bulletin No. 1124.
16e *Traylor Engrg. & Mfg. Co.

Crystallizers, Vacuum 8 p. booklet describes Swenson crystallizers—individually engineered for minimum cost, maximum recovery of crystals, top quality of product. Request illustrated Bulletin No. C-100.
135g *Swenson Evaporator Co.

Dealkalizing Salt Splitters Manufacturer of water conditioning equipment makes available a new reference—covers details of operation in addition to the numerous advantages. Publication No. 4567.
462D Cochrane Corp.

Discs & Cylinders Illustrated booklet covers features and advantages of Carter discs and Hart Uni-Flow cylinders . . . for length separation and sizing of grain, seed, and other granular materials.
462E Hart-Carter Co.

Dryers 20 p. catalog reviews the entire line of chemical processing, food processing, fertilizer and fish reduction equipment. Introduces and features the Dehydro-Mat. Request illustrated Bulletin No. 854.
TR867 *Edw. Renneburg & Sons Co.

* See explanation on p. 444

V-11

May 1955—CHEMICAL ENGINEERING

Dryers.....Lectro-dryers can dry air & gases in volume to dewpoints below -100°F—can drop relative humidity lower than 10%. Booklet describes machines & how various industries use them to gain efficiency.
104 *Pittsburgh Lectrodryer Corp.

Dryers, Rotary.....Deliver top production, exacting performance, greater profits. Tells how Standard-Hersey has aided manufacturers throughout the world in solving their dryer problems, in illustrated, 12 p.
314 *Standard Steel Corp.

Dryers, Rotary.....Dry without contamination from combustion gases, regardless of fuel. For complete information on the numerous advantages of Ruggles-Coles indirect-fired dryers, request Bulletin AH-439-11.
340 *Hardinge Co.

Dryers, Rotary.....Makes available an illustrated Catalog with valuable information on company's line of de-watering presses & screens, rotary steam tube, hot air & direct fire dryers, water tube & air coolers.
BL365a *Davenport Mach. & Foundry

Dryers, Spray.....Folder on research spray dryer—describes and illustrates Swenson's completely packaged spray dryer for laboratory and pilot plant operations. Request informative Bulletin No. D-106.
135d *Swenson Evaporator Co.

Drying Equipment.....To improve your product call on Proctor & Schwartz, who not only manufacture drying equipment, but have the know-how to help you in materials handling problems. Request Bulletin 390.
463 *Proctor & Schwartz.

Drying Equipment, Spray.....16 p. includes facts, photographs, and diagrams explaining the principles and advantages of spray drying and the Swenson plant-scale research laboratory. Request Bulletin D-105.
135e *Swenson Evaporator Co.

Dust Collectors.....In almost every type of industry... users have found high efficiency, simplicity & economy of Dustube collectors a difficult combination to equal for top performance. Catalog No. 372.
275 *American Wheelabrator.

Dust Control.....Company line of dust control equipment performs the vital service of product recovery and dust control in the numerous material processing operations. Offers complete descriptive literature.
440 *Ducon Co.

Dust Control.....Pangborn engineers help solve your dust problems—line of wet or dry dust collectors can save time, trouble & money. See how varied industries are benefited in "out of the Realm of Dust."
335 *Pangborn Corp.

Dust Control.....Pioneers and leaders in industrial dust control for all process operations—crushing, screening, milling, grinding, blending, mixing, drying, etc. Full data on flat bag dust filters in Bulletin 98.
457 *W. W. Sly Mfg. Co.

Dust Filters.....The cleaning efficiency of the Model F Electro-Matic extends over a wide range of particle sizes, from smoke to largest air-borne materials. Find complete product information in Bulletin No. 250.
75 *American Air Filter Co.

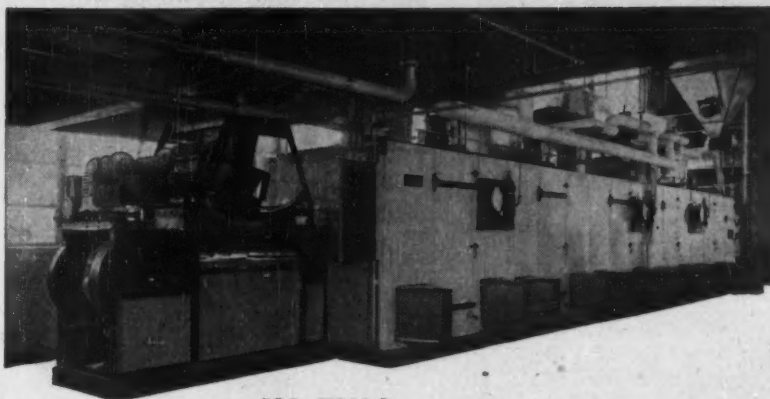
Dust Filters.....Help solve dust control problems. Describes the numerous advantages of using the Day line of high pressure reverse jet filters... for efficient dust control. Illustrated Bulletin No. 528-R.
304 *Day Co.

Evaporators.....Booklet on long-tube vertical evaporators—describes high capacity, steam-saving evaporators for concentrating mobile & foamy liquids & heat-sensitive materials. Illustrated Bulletin No. E-100.
135a *Swenson Evaporator Co.

* See explanation on p. 444

Picture

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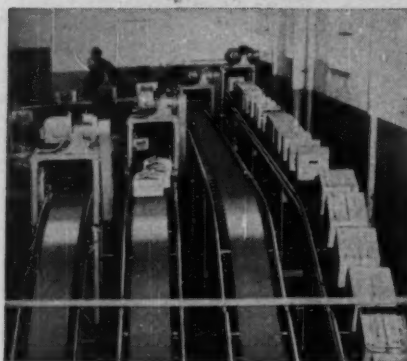
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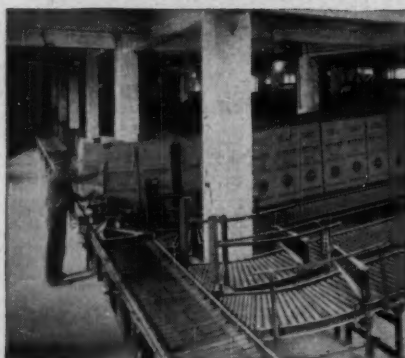


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LITERATURE . . .

Evaporators.....Booklet on forced circulation evaporators—tells about Swenson "F.C.P." evaporators for continuous economical concentration of viscous, salting & scaling liquors. Illustrated Bulletin No. E-107. 135b *Swenson Evaporator Co.

Filter Fabrics.....The right fabric adds efficiency to continuous operation. Announces availability of a fully illustrated booklet, "Filter Fabric Facts," describing filter fabric development and application. 75. *Wellington Sears.

Filters.....Handle wide ranges of fluids at wide ranges of flow rates and viscosities... capacities from a few to over 800 gpm... connections from 1/2 in. IPS to 6 in. flanged. Request Micro-Klean Bulletin. 57 *Cuno Engrg. Corp.

Filters, Pressure Leaf.....For flow rates two to five times greater than cloth covered presses; positive removal of all suspended solids to desired degree of clarity; etc. Find complete details in new Catalog NC-1-53. 330 *Niagara Filters Div.

Filters, Rotary Vacuum.....Covers design features... for handling both slow filtering & free filtering solids; how it discharges thin cake by pneumatic blow-back, & utilizes thorough counter-current wash. 6 *Bird Mach. Co.

Filters, String Discharge.....String Discharge handles almost any type of cake... thin, soupy slimes... heavy or coarse granular materials... or sticky gels. Details in illustrated Bulletin No. 103. 345 *Filtration Engrs.

Filters, Top-Feed.....Furnishes an illustrated folder describing Swenson's efficient, money-saving top-feed filter equipment that dewater and dries crystalline materials in one process. Bulletin No. F-101. 135f *Swenson Evaporator Co.

Filters, Vacuum.....Booklet on rotary-drum vacuum filters—describes & illustrates Swenson job-engineered filter equipment for continuous low-cost, efficient filtration & washing. Request Bulletin No. F-100. 135e *Swenson Evaporator Co.

Graders, Precision.....Provide methods of sizing or separating various grains & other granular materials by thickness & by width to degrees of exactness & uniformity heretofore unobtainable. Illustrated, 4 p. 464A *Hart-Carter Co.

Kilns, Rotary.....Efficient thermo-processing of products. Used in the production of lime, bauxite, cement, sodium silicate, alumina, etc. Complete data on design features offered in illustrated Bulletin No. 1115. 16b *Traylor Engrg. & Mfg. Co.

Mills, Ball.....A steel-head ball mill will suit your particular need. Five types of discharge trunnions. All-steel construction. Low initial cost due to quantity production. Quick delivery. Bulletin No. B2-B13. 370b *Denver Equipment Co.

Mills, Ball & Pebble.....Outstanding in the field of fine grinding, mixing and processing. Built of all steel welded construction, they feature great strength and ruggedness. 20 p. illustrated Catalogue No. 100. 318e *International Engrg.

Mills, Grinding.....Mills applicable for wet or dry, coarse or fine grinding. Assure a uniform product of desired fineness. Improved design and construction features fully described. Illustrated Bulletin No. 8121. 16d *Traylor Engrg. & Mfg. Co.

Mills, Rock-Emery.....For fine grinding of soft & moderately hard materials such as clay, shale, chalk, etc. Includes description, sizes made & approximate capacity per hour on average materials. Illustrated. 464B *Sturtevant Mill Co.

* See explanation on p. 444

Mills, Roller.....For grinding chemicals, pigments and a great variety of non-metallics and manufactured products, Raymond roller mills offer you an economy-proved method of production. Request Catalog 72.
332 *Raymond Div.

Mixers.....Data on turbine & slow speed heavy duty agitators... for open & closed tanks. Covers operation & applications of super-turbine & injection mixers, mixer data, mixer drive heads, etc. Bulletin No. 76.
318a *International Engrg.

Mixers.....Shows new Type L mixer with air motor for laboratory and small job mixing. New type patented stirrers, size 1 and 2, are furnished with each motor. Complete details in illustrated Bulletin 551.
465A Conn & Co.

Mixers.....Company makes available Confidential Mixing Data Sheet. Helpful checklist enables you to develop a complete technical description of agitation required for your process, quickly & easily. No. B-107.
125b *Mixing Equipment Co.

Mixers.....Company furnishes illustrated literature describing their line of Mixall Mixers... the intensive mixers with "claw" mixing propellers. Includes data on features, models, propeller specifications, etc.
465B Craddock Equipment Co.

Mixers, Dry.....Describes conical blenders (design, operation, application, capacity, sizes & specifications) & ribbon mixers (operating & construction features, specifications, etc.) Illustrated Bulletin No. 78.
318b *International Engrg.

Mixers, Portable.....Includes information on the numerous features and advantages, materials of construction, sizes and specifications, portable-permanent mountings, etc., in illustrated Bulletin 74-A.
318c *International Engrg.

Mixers, Portable.....New 16 p. catalog provides product data & extremely helpful engineering information & diagrams... a guide to choosing proper portable mixer & accessories. Illustrated Bulletin No. 520.
465C Eastern Industries.

Mixers, Side Entering.....The Type "NU" side entrance mixer is a brand new unique mixer design. It has no cast parts and is of all welded construction, including the stuffing box. Illustrated Bulletin No. 72-A.
318d *International Engrg.

Presses, Filter.....Presents new Catalog & Specification Book. Helps to improve your understanding of a vital process... aids in the selection of the proper equipment for your specific filtration requirements.
306 *D. R. Sperry & Co.

Process Equipment.....Illustrated, 32 p. includes sections on: equipment for chemical unit operations; process plant electrical apparatus; mechanical power transmission equipment; etc. Bulletin 25C6177J.
465D Allis-Chalmers Mfg. Co.

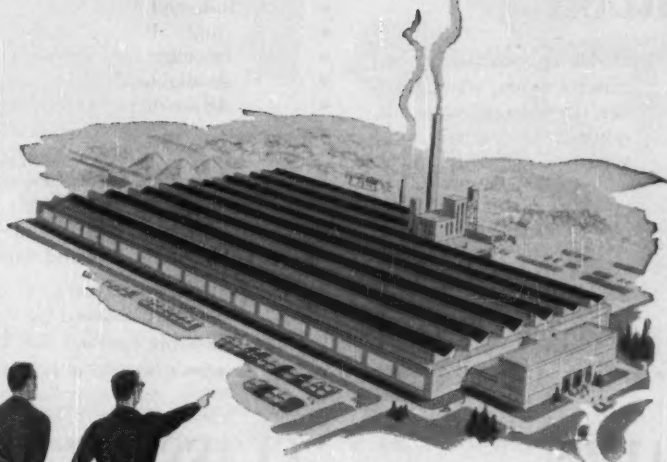
Processing Equipment, Liquid.....Offers a new, fully illustrated 32 p. bulletin describing "Sealed-Disc" & "Disc-Pak" filters, transfer pumps, portable mixers, tanks, agitators, etc. Request Bulletin No. G-255.
465E Alsop Engrg. Corp.

Roll-Setting.....Hydra-Set is a unique hydraulic roll-setting device that takes all guesswork out of roll settings. Comes as optional equipment on new mills or as field conversion kit. Spec. Sheet No. 1-400 R.M.
364 *J. H. Day Co.

Samplers.....Covers automatic sampling & its application to many different problems. Includes specifications, detailed data, charts, photographs, etc. which graphically describe samplers. 12 p. Bulletin S1-B4.
370a *Denver Equipment Co.

* See explanation on p. 444

DO YOUR SCALES ADD UP TO A Weighing System?



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LITERATURE . . .

Screens, Wire. . . . Wire screens for rugged vibrating tasks offer valuable features: extra strength; longer screen life; drum-tight tension; no pull-out; no sag; etc. Full details in illustrated booklet.

466A Cleveland Wire Cloth & Mfg.

Separators, Centrifugal. . . . Furnishes upon request the "Merco Capacity Calculator"—a fast method to approximate the size Merco centrifuge required in your process. Describes Merco Rental Plan. Form 5409.

466B Merco-Centrifugal Co.

Thickeners, Spiral Rake. . . . Simple mechanical rake and settling unit for the separation of solids from liquid is subject of a new, detailed Bulletin. Valuable features, drawings, photographs, etc. No. T5-B5.

370e *Denver Equipment Co.

Trays, Bubble. . . . Glitsch "Truss-Type" bubble trays serve all processing plants . . . chemical—petro-chemical—natural gasoline—petroleum refining—A E C—etc. For details, request Technical Bulletin.

356 *Fritz W. Glitsch & Sons.

Vessels. . . . If your process involves high pressures, high temperatures or corrosive materials, design with Multilayer. Request "Multi-Layer Manufacturing & Assembling" & "Multi-Layer Engineering for Safety."

54-5a *A. O. Smith Corp.

Washers, Pulp. . . . Data on Swenson recovery equipment for pulp mills—illustration, description and discussion of pulp washers, explaining the advantages of advanced engineering features. Bulletin No. E-108.

135h *Swenson Evaporator Co.

Wire Cloth. . . . 84 p. catalog describes company's facilities for fabricating wire cloth parts. Includes wire cloth parts for screening, filtering and special uses. Also provides helpful metallurgical information.

338 *Cambridge Wire Cloth Co.

Wire Cloth. . . . Newark metallic filter cloth is available in a variety of weaves in all malleable metals, and is adaptable to practically all types of filters. Offers complete details in company's new Catalog E.

452 *Newark Wire Cloth Co.

Pumps, Blowers, Compressors

Blowers. . . . Complete dimensions, specifications & performance data on new non-overloading utility blowers with backward curved blades is presented in concise, easy-to-use form in a new Bulletin, No. BC-11.

466C Hartzell Propeller Fan Co.

Compressors. . . . Reversible ring plate valves, force feed lubrication, sealing type piston rings, generous intercooler coils are features which make for efficiency and long-term economy. Descriptive Catalog.

474 *Norwalk Co.

Compressors. . . . Gas-engine-driven compressors in 330 to 550 hp range are the subject of a new 44 p. bulletin. Describes all the features of Type SVG four-cycle compressors. Request illustrated Form No. 3128-A.

466D Ingersoll-Rand Co.

Compressors, Balanced/Opposed. . . . Complete line of balanced/opposed compressors in 150 to 4500 hp range is available in various cylinder arrangements to meet practically any requirement. Bulletin No. 118.

391 *Clark Bros. Co.

Compressors, Centrifugal. . . . Offers a complete line of centrifugals for gas compression and refrigeration—up to 10,000 horsepower in a single unit. Details in "Centrifugal Compressors for Industry."

376 *Carrier Corp.

* See explanation on p. 444

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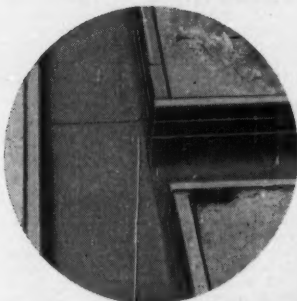
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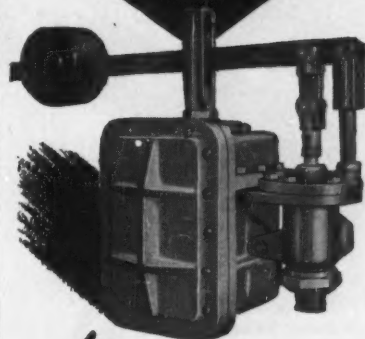
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CH5

LITERATURE . . .

Pumps. Oil-lubricated pumps offer simple design, yet have all features required for low cost, low maintenance operation at high temperatures. Details of design and construction features in Bulletin 52B7638.
98 *Allis-Chalmers Mfg. Co.

Pumps. Handle most anything that can pass thru a pipe, from free-flowing liquids to non-pourable pastes—even materials containing relatively large particles or abrasives. Moyno Pump Bulletin No. 30-B.
319a *Robbins & Myers.

Pumps. Series H. Durcopumps designed to solve your tough pumping problems, & to meet your own special requirements. Built for high heads & low capacities, as well as routine transfer services. Bulletin P/8.
231 *Duriron Co.

Pumps. Specially built for handling chemical solutions, efficiently and economically . . . in the processing industries. Describes vertical pumps in Bulletin No. V-837 and horizontal pumps in Bulletin No. C-355.
L470 *Taber Pump Co.

Pumps, Centrifugal. Describes new line of centrifugal pumps designed especially for handling corrosive liquids and slurries. Complete information, including performance data, found in Bulletin No. 725.4.
92 *Goulds Pumps.

Pumps, Centrifugal. Impervious graphite pumps feature mechanical seal with enclosed coolant, rugged type SN armored connections, interchangeable parts, wide capacity range, etc. Catalog Section S-7250.
247a *National Carbon Co.

Pumps, Centrifugal. Meet strict process requirements . . . with Eastern centrifugal pumps. New catalog contains engineering data, performance charts, diagrams & helpful general information. Bulletin 110A.
379 *Eastern Industries

Pumps, Centrifugal. Original manufacturer of self-priming centrifugal pump offers data on new Type CG LaBour—operates under positive or negative suction lift conditions as required. Request Bulletin G-1.
245 *LaBour Co.

Pumps, Centrifugal. Specially built centrifugal pumps are used to handle abrasive & corrosive sludges, slimes & slurries. They give maximum pumping service for years. Descriptive Bulletins available on request.
443 *McNally Pittsburgh Mfg. Corp.

Pumps, Controlled Volume. Application Engrg. Data Sheet describes use of controlled volume pumps to meter any small quantities of chemical reagents in both dry & wet processing phases. Data Sheet H-54-2.
468A Milton Roy Co.

Pumps, Controlled Volume. Describes the use of controlled volume pumps in solving low capacity flows of papermakers chemicals in stock preparation, actual installations discussed. Data Sheet F-55-1.
468B Milton Roy Co.

Pumps, Diaphragm. Adjustable stroke diaphragm pumps can be adjusted while pump is running to regulate & control flow of thickened pulp. Useful in counter-current decantation circles. Bulletin P8-B7.
468C Denver Equipment Co.

Pumps, Gear. Steam jacketed herringbone gear pumps handle viscous materials of many types, in a wide range of temperatures. Covers data on types, operating ranges, design features, etc., in Bulletin No. 17-A.
211 *Schutte & Koerting Co.

Pumps, Liquid. Pump viscous fluids efficiently and economically . . . and serve as combined meter and pump due to their unusually high volumetric efficiency. Describes the entire line in Bulletin No. L51.
441 *Kinney Mfg. Div.

* See explanation on p. 444

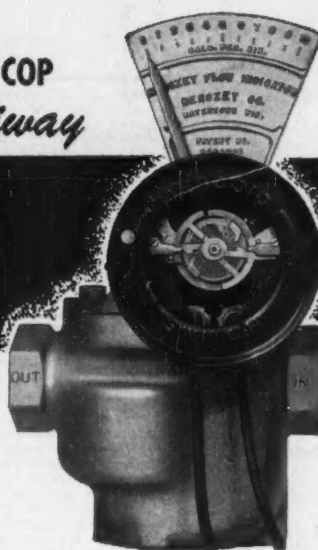


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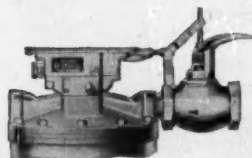
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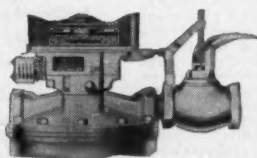
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377 *Lapp Insulator Co.

Pumps, Process De Laval CPO
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uids: salt brine; sea water; caustic
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pumps, Underwater pumps, jacketed
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470A *Viking Pump Co.

Pumps, Sand Soft rubber lined sand
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370e *Denver Equipment Co.

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61 *Chempump Corp.

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285 *Struthers Wells Corp.

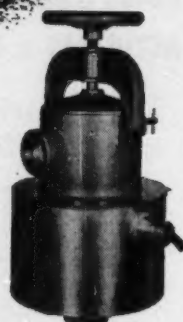
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382 *Blaw-Knox Co.

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370d *Denver Equipment Co.

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80a *Gardner-Denver Co.

Water Treatment.....The dangers of scale and corrosion in cooling systems and organic contamination of cooling system water outlined in 6 p. folder issued by water treatment consulting firm. "Cooling Water."
471F Hall Labs

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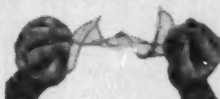
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CHEMICAL ENGINEERING—May 1955



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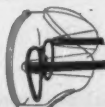
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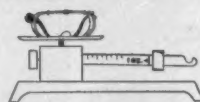
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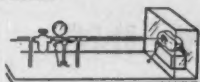
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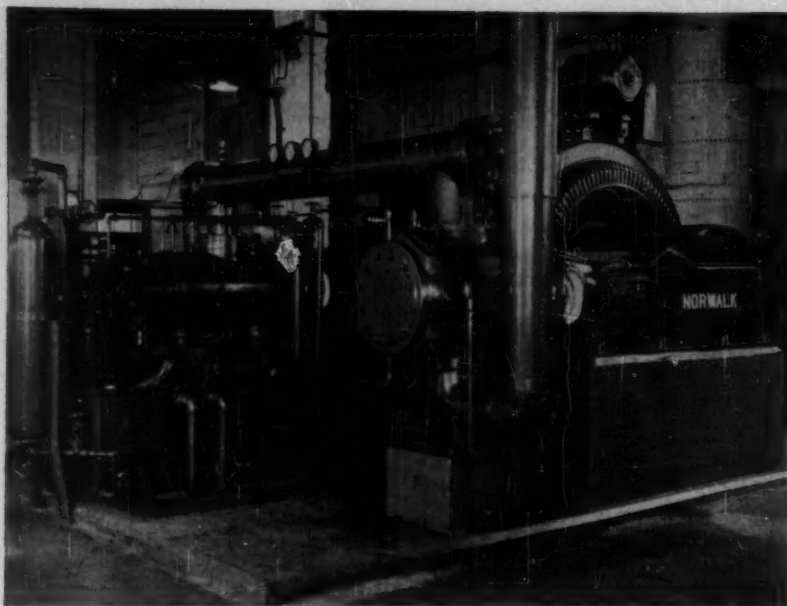
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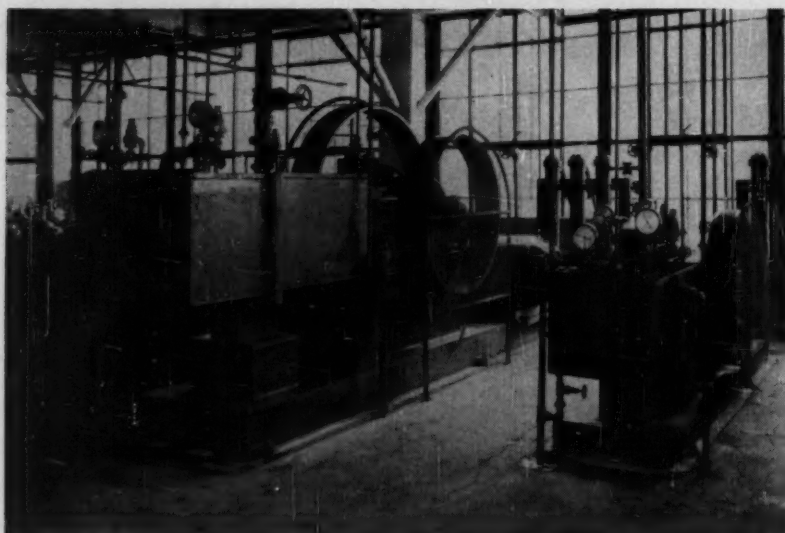
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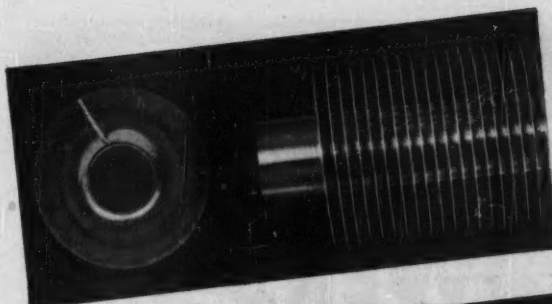
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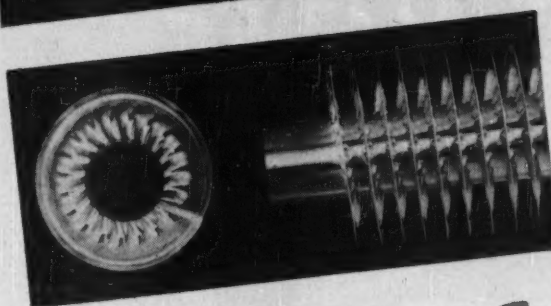
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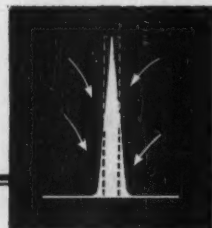
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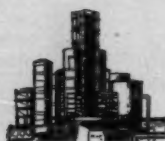
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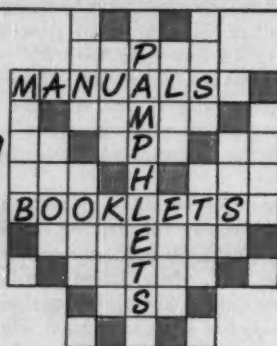
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17	65	104	149a	232e	256B	305	336h	364	392	445D	440GG	453	460	L471
20	66	106	149b	232f	256C	306	337a	TL365	393	445E	440HH	453A	460A	R471
21	67	108	149c	232g	256D	307	337b	BL365a	395	445F	440I	453B	460B	471A
24	68	113	149d	233	257	308	337c	BL365b	399	445G	440JJ	453C	460C	471B
25	69	115a	149e	235	257A	311	337d	BL365c	402a	445H	447	453D	TL461	471C
27	70	115b	150A	237	257B	312	338	R365	402b	445I	447A	TL463	BL461	471D
28-9	75	115c	150B	239a	258C	314	339	366	408	445J	447B	BL463	R461	471E
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39	80f	125e	153G	247c	269	319b	345	370c	441	445H	447L	454H	464B	484c
40	80g	125f	153H	247d	271	319c	346							

(Card expires August 1)

140A	144B	140C	148D	148H	245A	248D	248G	250C	254A	254D	258C	258A	258D	260C
142A	144C	148A	148E	148I	245A	248E	250A	250D	254B	258A	258D	258B	260A	260D
142B	148A	148B	148F	148J	248B	248F	250B	252A	254C	258B	258E	258C	260B	260E
144A	148B	148C	148G	245A	245C									

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HOW IT WORKS. Dynamic braking is obtained with a patented* unique, multi-polar brake winding superimposed on the stator winding of any Master single-phase or polyphase induction motor.

ADVANTAGES. Unibrake motors with dynamic braking are very compact, usually no larger than the standard motor. And since the dynamic brake has no moving parts, there is no wear . . . nothing to adjust . . . braking torque remains uniform.

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SIZES. Now available up to 30 horsepower . . . larger ratings are being developed. Master Gearmotors and variable speed drives can also be supplied with Type D Unibrakes.

LITERATURE. For complete information write for Data 3810.

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Corrosioneering News

Quick facts about the services and equipment Pfaudler offers to help you reduce corrosion and processing cost.



Your columns can pay their way faster, give extra years of service

Corrosion and rapidly changing process requirements sometimes make a column unusable or obsolete before it has had a chance to earn its keep.

One way you may be able to whip corrosion is by using the protection of Pfaudler's acid-alkali-resistant glass. It shrugs off attack by all acids except hydrofluoric, and alkaline solutions up to pH 12 at 212° F.

This glass is standard on Pfaudler glassed steel packed, or grid tray columns for fractionation, absorption, stripping, adsorption and extraction.

Because of its very wide range of corrosion resistance, Pfaudler glassed

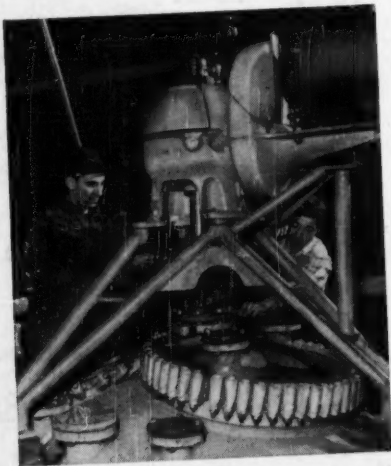
HAVE YOU HEARD

about Pfaudler's unique new guarantee against corrosion of glassed steel equipment? Read about it in Pfaudler's special 4-page section of this magazine!

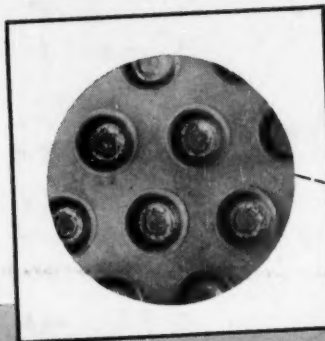
steel is also more flexible when you change processes — often saving you the cost of new equipment.

Standard Pfaudler glassed steel columns are rated for full vacuum and internal pressure starting at 25 psig. For higher pressures, special units can be custom built.

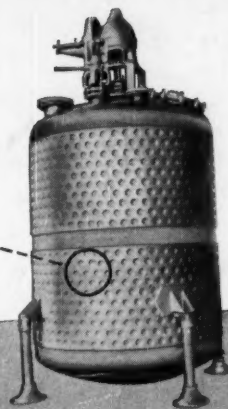
For extra corrosion resistance, and for process flexibility, ask your Pfaudler representative about glassed columns — or write for Bulletin 907.



Pfaudler Preventive Service Plan provides qualified instruction for your personnel, periodic inspection of equipment.



Close-up of Pfaudler stainless steel jacket, showing reinforcing "dimples" that provide extra strength.



\$600 was saved on material alone, by using dimpled construction for this special reactor.

"Dimpled" jackets reduce cost of stainless reactors for high pressure

If you use stainless steel reactors in the capacity range of 750 to 2000 gallons, you may be able to save up to 20% in over-all cost, by using Pfaudler "dimpled" jackets instead of the conventional type.

Greatest savings are realized when your jacket pressure rating is 150 psi, but even when you need only a 50 psi rating, you'll find the dimpled construction more economical.

Pfaudler's dimpled construction is a method of increasing the structural strength of a vessel, without adding to the thickness of the material. Thus, you are able to handle higher pressures without a basic increase in material cost.

Using this dimpled jacket construc-

tion, Pfaudler stainless steel reactors are available to you as standard models, in capacities from 750 to 2000 gallons. This means you enjoy additional savings, by eliminating the cost of custom design and custom fabrication.

Of course, designs can be built to meet special needs such as internal vacuum, or unusual sizes.

Pfaudler dimpled construction is approved by the National Board of Boiler and Pressure Vessel Inspectors for 150 psi jacket pressure, and may be code stamped.

If you've a high-pressure reaction, look into the economies of dimpled stainless steel construction. Write, or consult your Pfaudler representative.

PSP ... A Pfaudler service that nips your maintenance problem in the bud

In several areas of the United States, Pfaudler offers a *Preventive Service Plan*. This program provides, on a contract basis, for periodic visits to your plant by a factory- and field-trained Pfaudler service engineer.

He is equipped with tools, materials, and experience to instruct your personnel and to inspect, adjust and repair your Pfaudler glassed steel or alloy equipment.

His recommendations on maintenance procedures and his frequent inspections can help you head off the need for large, costly repairs, and get maximum use out of your reactors, heat exchangers, columns and other processing equipment.

You may be in an area now being offered this valuable service. Write for your copy of the Pfaudler bulletin explaining Preventive Service Plan.

Pfaudler

THE PFAUDLER CO., ROCHESTER 3, N.Y.